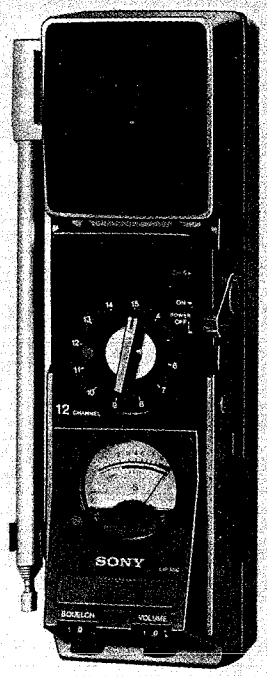
ICB-1020

AEP Model



CITIZENS BAND TRANSCEIVER

SPECIFICATIONS

GENERAL

Operating Frequency: Within the 27.005 to 27.135 MHz band 4 to 15 channels

Antenna: Telescopic Antenna
Approx. 149 cm (4 feet 10 inches)

Communication System: Push-to-talk system (one-way system)

Power Requirement: 12 V dc
Battery size-AA, 8 pcs.
(IEC designation R6)
Car battery cord DCC-6 for 12 V car battery

Dimensions: Approx. 92 (w) x 270 (h) x 103.5 (d) mm
$3\frac{5}{8}$ (w) x $10\frac{5}{8}$ (h) x $4\frac{1}{2}$ (d) inches
including projecting parts and controls

Weight: Approx. 1250 g, 2 lb 12 oz with batteries

TRANSMITTING SECTION

Transmitting Power: 1 W

Frequency Tolerance: ±0.005% (-30°C to +60°C)

Circuit System: PLL synthesizer with quartz crystal controlled circuit

Modulation: Collector moduration in final and driver stage

Current Drain: 250 mA without modulation

RECEIVING SECTION

Circuit System: PLL synthesizer with quartz crystal controlled circuit
Dual conversion superheterodyne

Maximum Sensitivity: Less than 0.5 μV at 50 mW output

Intermediate Frequency: 1st: 10.695 MHz
2nd: 455 kHz

Audio Power Output: 340 mW at 10% distortion

Current Drain: 70 mA at zero signal

Speaker: Approx. 5.7 cm (2¼ inches) dia., 8Ω

Transmitting and Receiving Frequencies:

Channel	Frequency	Channel	Frequency
4	27.005 MHz	10	27.075 MHz
5	27.015 MHz	11	27.085 MHz
6	27.025 MHz	12	27.105 MHz
7	27.035 MHz	13	27.115 MHz
8	27.055 MHz	14	27.125 MHz
9	27.065 MHz	15	27.135 MHz

SONY®

SERVICE MANUAL

SECTION 1
OUTLINE

1-1. TECHNICAL DESCRIPTION

PLL SYNTHESIZER CIRCUIT OPERATION

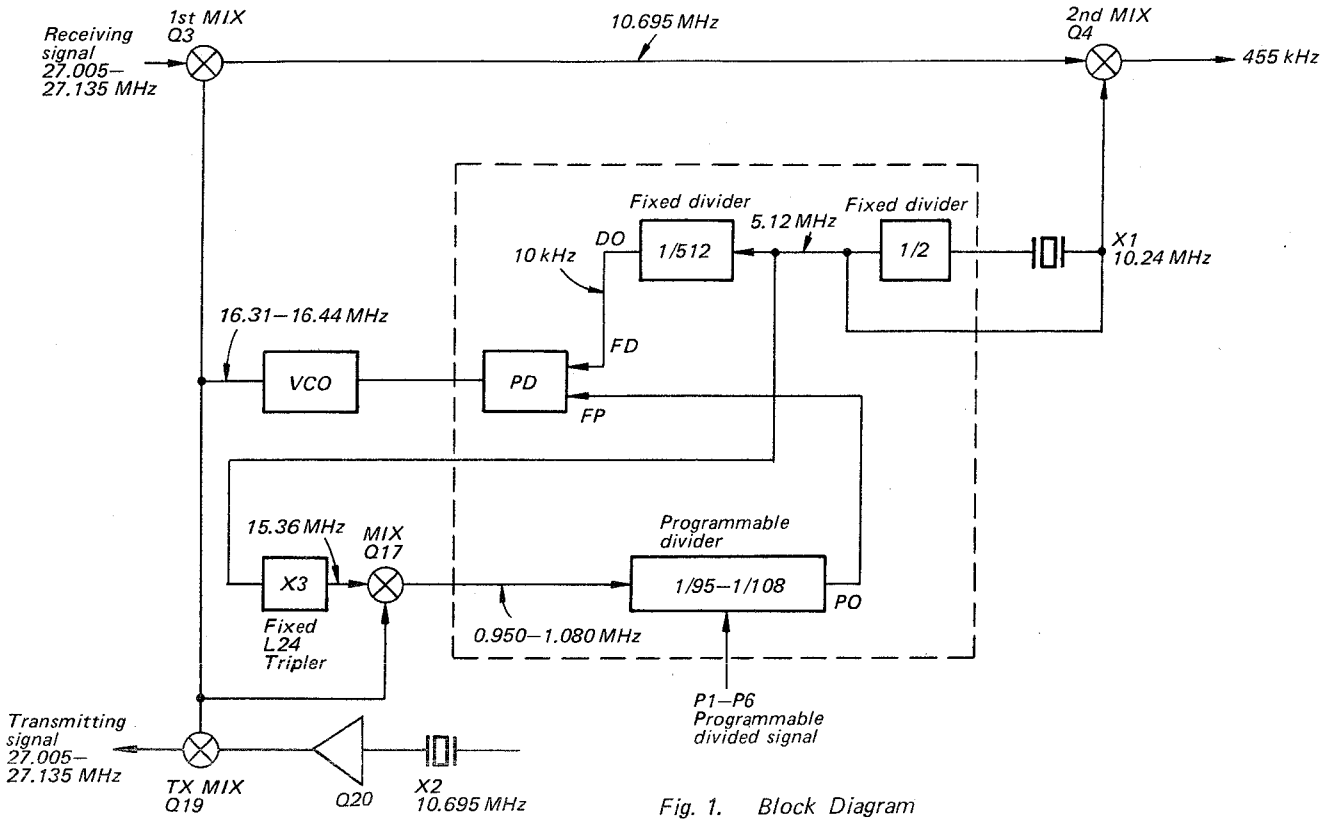


Fig. 1. Block Diagram

As shown in Fig. 1, the frequency of the VCO (Voltage Controlled Oscillator) is varied between 16.31–16.44 MHz (CH4–15) in 10 kHz steps according to the position of the channel selector. The output of the VCO goes to the PD via Q17 and the programmable divider and is compared with the 10 kHz reference signal which is obtained by dividing the 10.24 MHz signal from X1. The PD detects a phase difference between the output of the VCO and the 10 kHz reference signal, so that the oscillation frequency of the VCO is maintained at constant frequency. This system is called a PLL (Phase Locked Loop), and is a type of frequency synthesizer.

(1) Reference Frequency

The 10 kHz signal from the DO (Divider Output) is the reference signal since it is closely related to the 10 kHz steps of the transmitting and receiving signals. The 10.24 MHz signal from X1 is converted to a 10 kHz signal by the $1/2$ and $1/512$ fixed dividers.

(2) Second Local Oscillator Signal

This set uses a double superheterodyne circuit. The second i-f is 455 kHz. The first i-f is about 10 MHz for better image rejection. Because of this, the 10.24 MHz of X1 can be used as the second local oscillator frequency. As a result, the first i-f is 10.695 MHz (455 kHz + 10.24 MHz).

(3) First Local Oscillator Signal

Since the second local oscillator is fixed in frequency, the receiving frequency is controlled in 10 kHz steps by the first local oscillator. The signal of the first local oscillator comes from the VCO and is controlled by the PLL frequency synthesizer. The frequency of the VCO is 16.31–16.44 MHz which is lower than the receiving frequency by the amount of the first i-f.

(4) VCO Scaling

To supply about a 1 MHz input to the programmable divider, the output of the VCO is lowered by the use of Q17 (MIXER). Here, if the input from the VCO is in the 16 MHz band, the local oscillator signal must be in the 15 MHz band. To obtain the signal, the 10.24 MHz signal from X1 is divided by the ½ fixed divider and then is converted to the 15.36 MHz signal (the third harmonic) by the L24 (TRIPLER).

For example, when the VCO oscillates at 16.31 MHz, the output of the VCO is mixed with the 15.36 MHz signal, and then the 950 kHz difference signal comes on as the input to the programmable divider.

(3) Active Filter and VCO Connection

The active filter (LPF) primarily consists of R1 and CF to make a 6 dB/oct curve, and the negative feedback from CF extends the linear range of the frequency response curve shown in Fig. 11. R2 is provided to make this LPF operable for the high frequency components of the input.

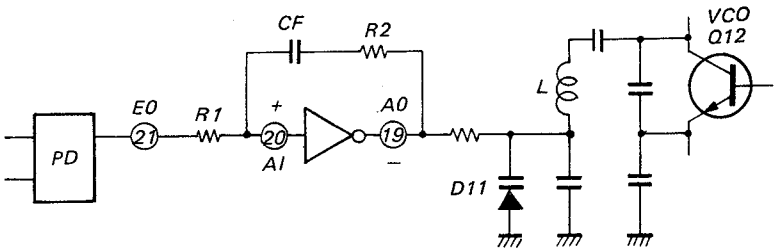


Fig. 10. Active filter and VCO connection

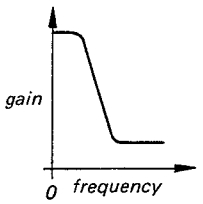


Fig. 11. Frequency response of LPF

(4) Phase Detector Overall Operation

Considering the overall operation, if the frequency of the VCO is assumed to be higher than desired:

- ○ The PD output (EO) sends out a positive pulse close to VDD.
- ○ This pulse is filtered by the active filter, and since the filter amp inverts the polarity, the filter output is dc approaching ground level.
- ○ The reverse bias applied to D11 decreases and its equivalent capacitance increases.
- ○ Since D11 is connected as a part of the VCO oscillation circuit, the oscillation frequency decreases and is locked at the desired frequency.

(5) μPD861C

Since the internal operation has already been described in the PLL section, only the other operations are described here.

VDD is 5 V.

The dividing ratio of the programmable divider is 3–255. Moreover, the maximum frequency of the input is approximately 2 MHz.

The maximum frequency of the signal applied to terminals X1 and X2 is 11 MHz. LOW (0) and HIGH (1) for all the signal inputs and outputs indicate:

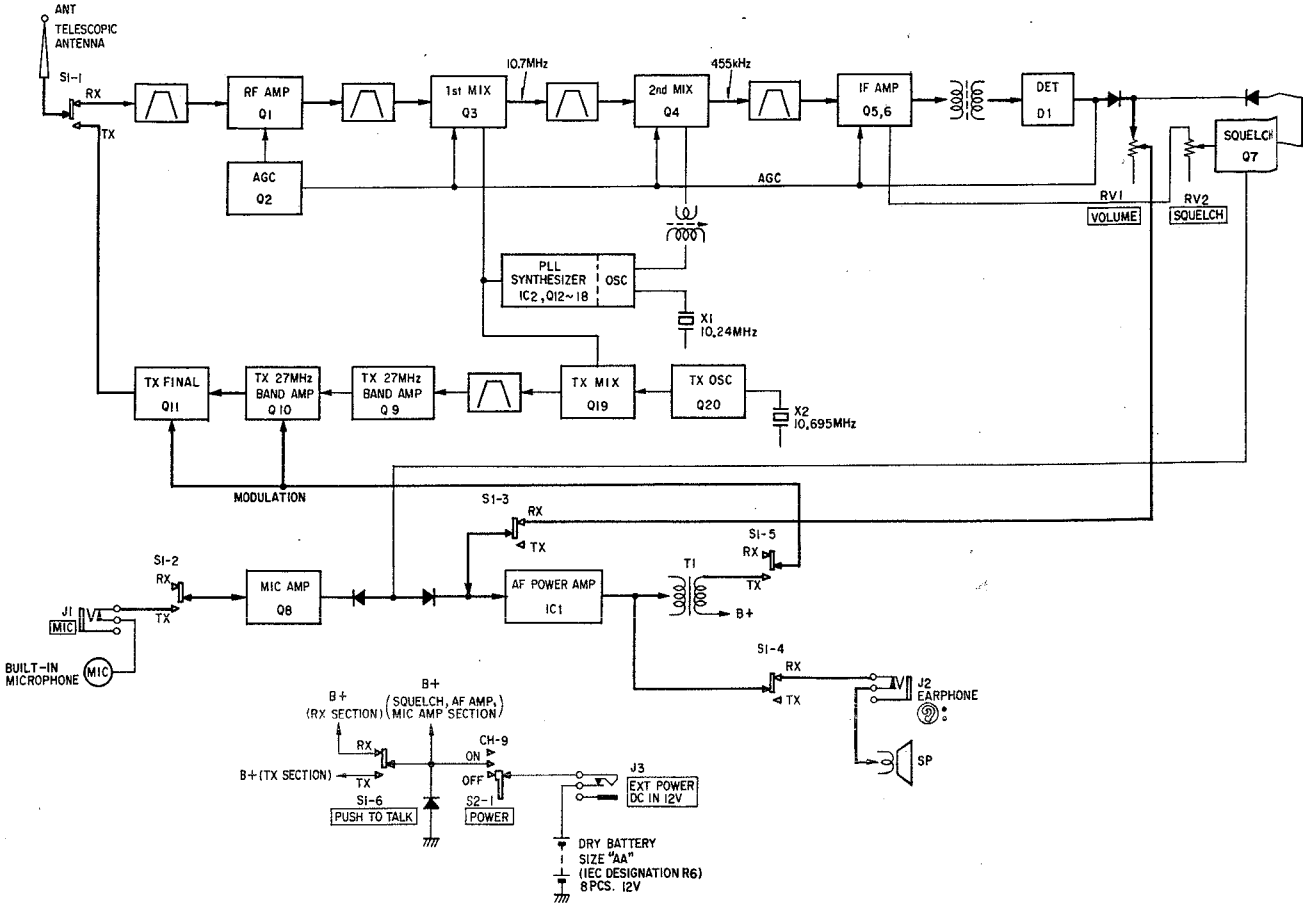
0 ---- 1 V or less

1 ---- 4 V or more

To set the divider in BCD code, the terminal M is HIGH level to get a 90 offsetting. When this terminal M is held LOW, the divider is not performing at 90 offsetting and is divided by the specified number of the BCD code.

N of 0–2 should not be programmed when direct division is performed.

1-2. BLOCK DIAGRAM



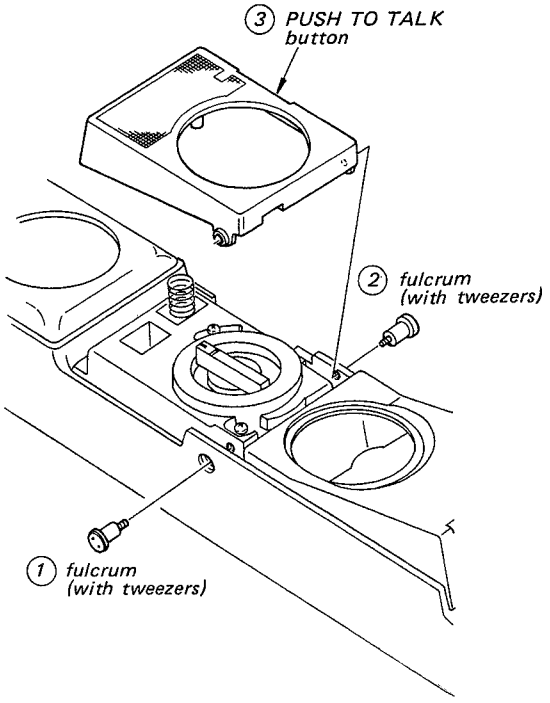
SECTION 2
DISASSEMBLY

2-1. REMOVAL AND INSTALLATION

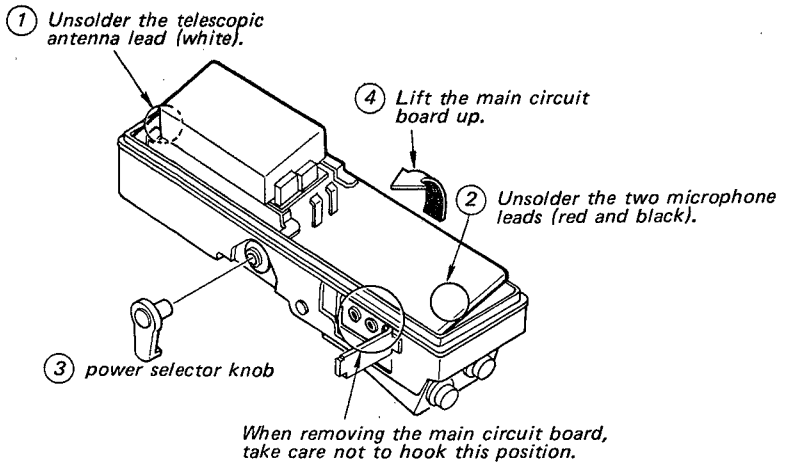
Rear Case Removal

Remove six screws.
B 3 x 60 (four) and
B 3 x 50 (two).

PUSH TO TALK Button Removal



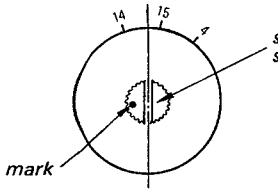
Main Circuit Board Removal

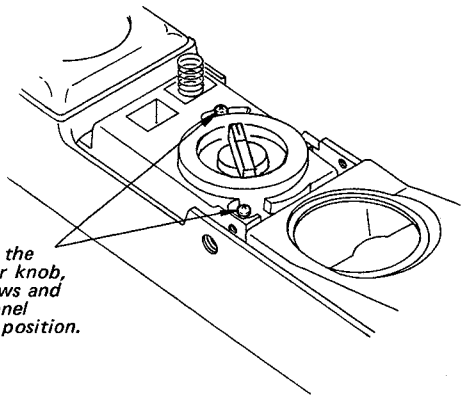

(1) Unsolder the telescopic antenna lead (white).
(4) Lift the main circuit board up.
(2) Unsolder the two microphone leads (red and black).
(3) power selector knob
When removing the main circuit board, take care not to hook this position.

Channel selector switch can be removed.

Note on Replacing Channel Selector Knob and Switch

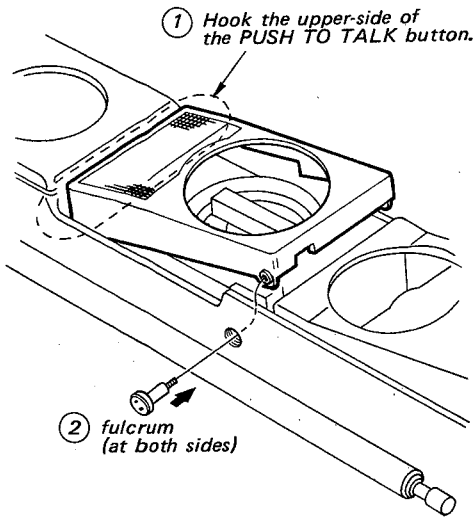
(1) *Set the shaft of the channel selector switch as shown below. And set the channel selector knob in the four channel position.*





(2) *After installing the channel selector knob, loosen the screws and adjust the channel selector switch position.*

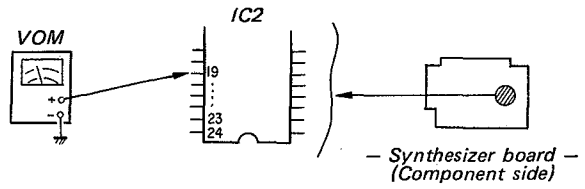
PUSH TO TALK Button Installation



VCO Adjustment

Procedure:

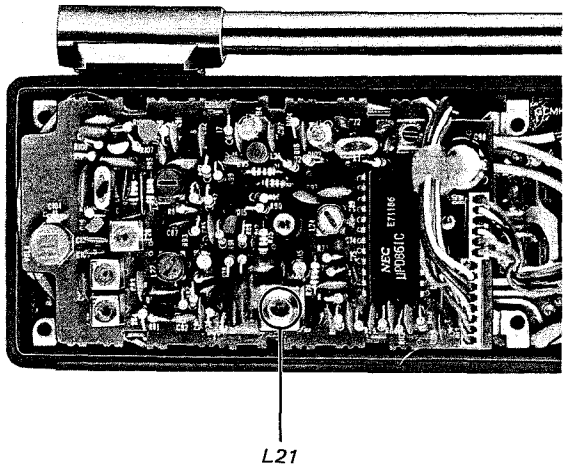
Mode: receive



1. Channel selector: 4
   Adjust L21 with a plastic hexagonal screwdriver for a 1.2V dc reading on the VOM.
2. Change the channel selector from 4 through 15 VOM reading should gradually change from 1.2V (channel 4) to about 1.8V (channel 15).

Adjustment Location:

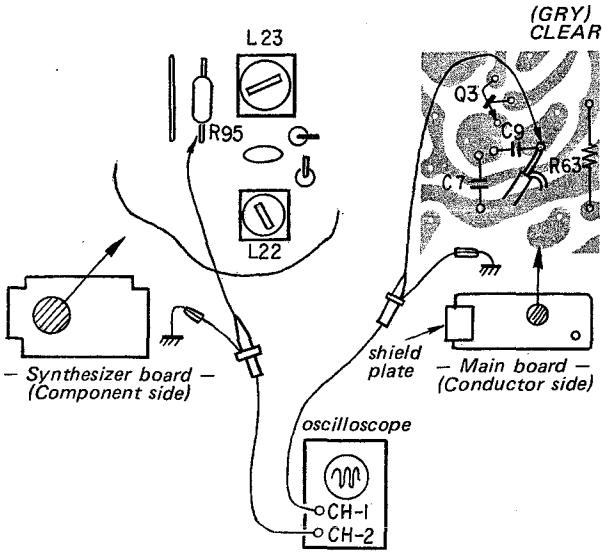
– Synthesizer board –



PLL Output Adjustment

Procedure:

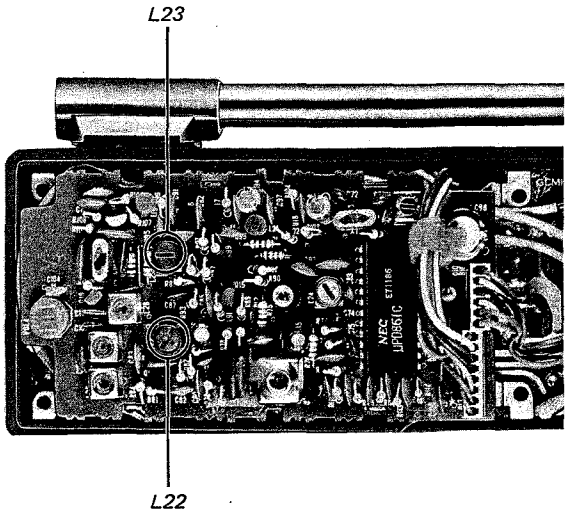
Mode: receive



1. Adjust L22 for a maximum waveform reading on the oscilloscope at R95 (CH2).
2. Adjust L23 for a maximum waveform reading on the oscilloscope at C9 (CH1).

Adjustment Location:

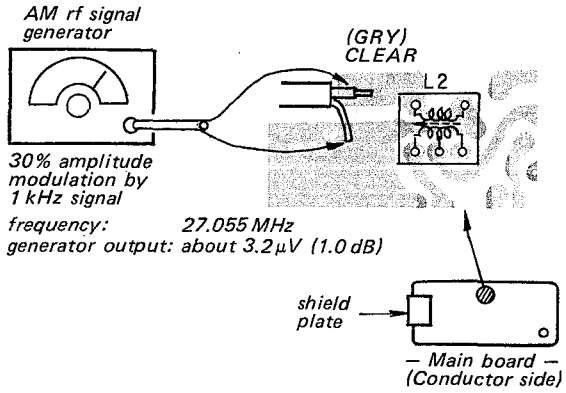
– Synthesizer board –

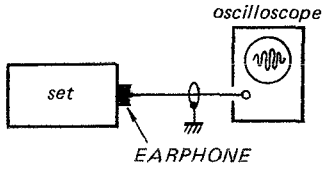


RX RF, 1st IF and 2nd IF Adjustment

Procedure:

Mode: receive

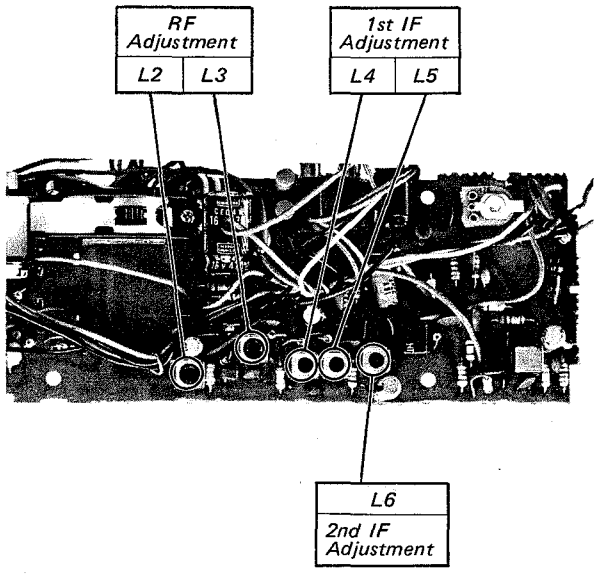




Adjust L2 through L6 for a maximum waveform reading on the oscilloscope.

Adjustment Location:

– Main board –



SQUELCH Adjustment

Setting:

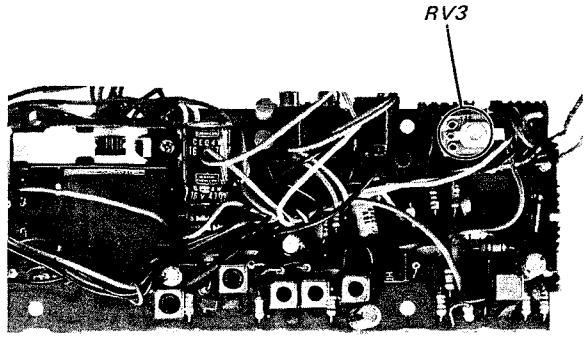
SQUELCH control: center of rotation
Mode: receive

Procedure:

1. Adjust RV3 to the point where the noise output from the speaker just disappears.
2. Turn SQUELCH control from minimum to maximum and check that squelch operates and noise disappears at the center of SQUELCH control rotation.

Adjustment Location:

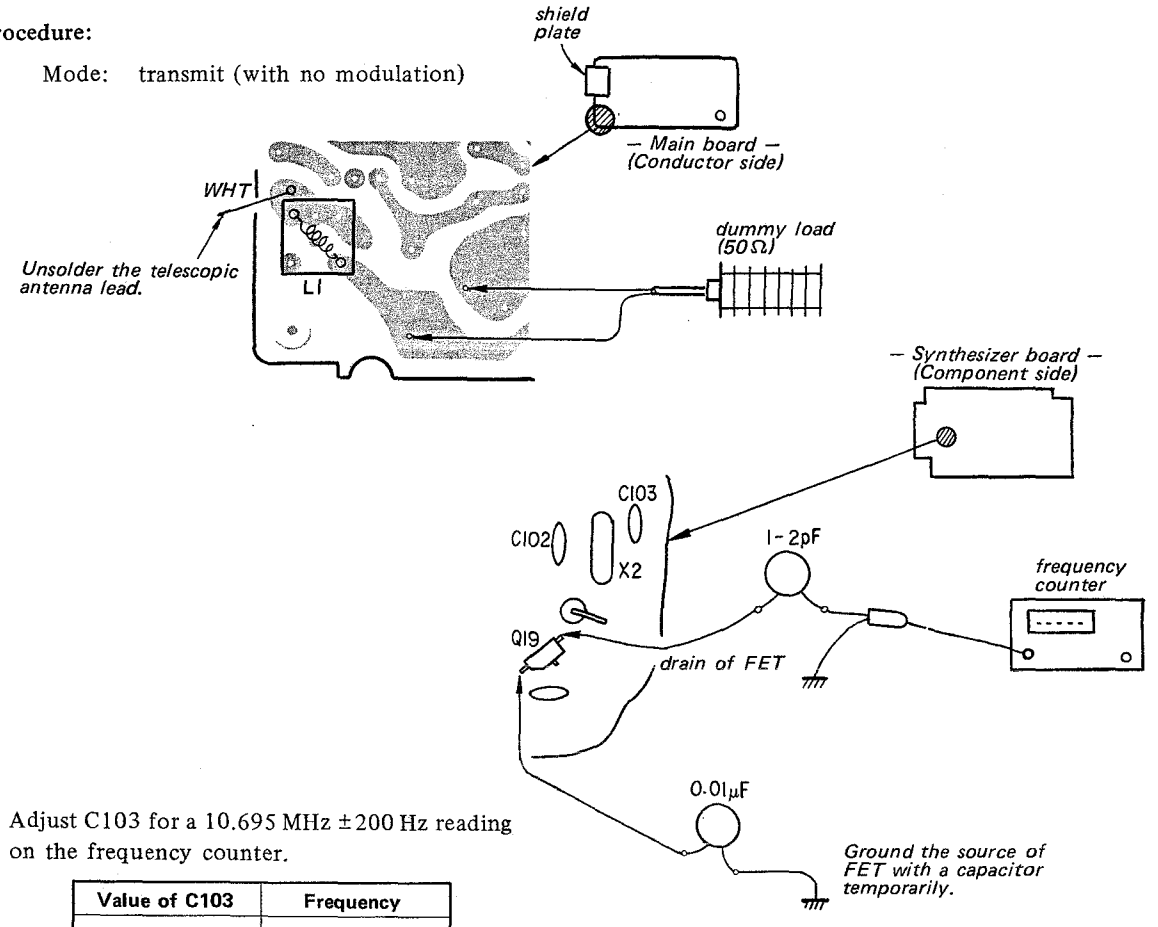
– Main board –



TX 10.695 MHz Osc Adjustment

Procedure:

Mode: transmit (with no modulation)

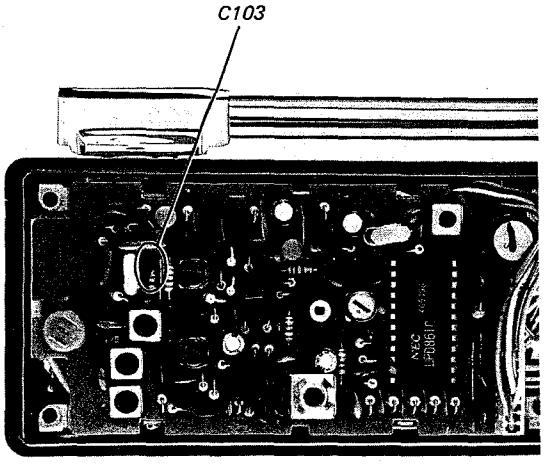


Adjust C103 for a 10.695 MHz ±200 Hz reading on the frequency counter.

Value of C103	Frequency
small ↕ large	up ↕ down

Adjustment Location:

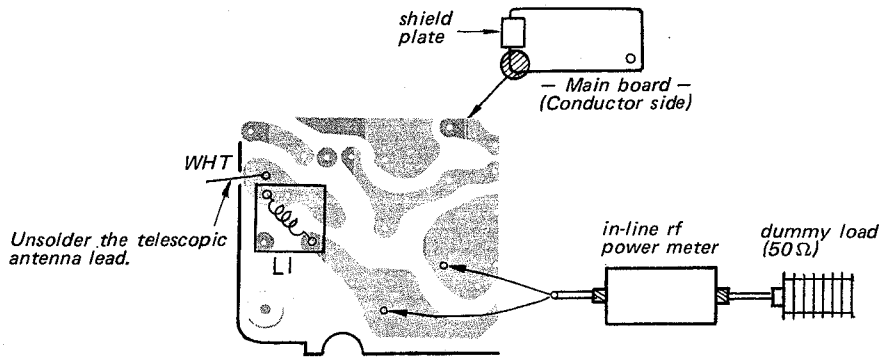
– Synthesizer board –



TX CW Output Adjustment

Procedure:

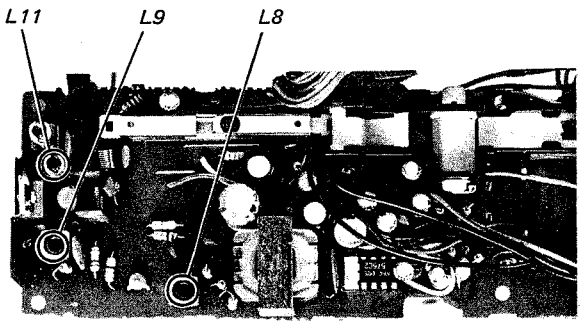
Mode: transmit (with no modulation)



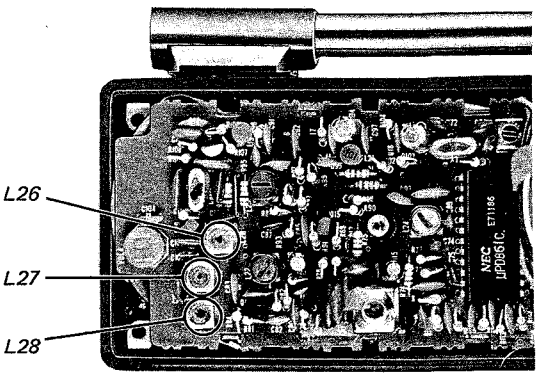
1. Adjust L11, L9 and L8 for a maximum reading on the in-line rf power meter.
   The reading should be 1W±0.2W (about 20Vp-p).
2. Set the channel selector to the channel 15 and adjust L28 and L26 for a maximum reading on the in-line rf power meter.
3. Set the channel selector to the channel 4 and adjust L27 for a maximum reading on the in-line rf power meter.
4. Repeat above steps several times and make the difference between the meter readings to be small.

Adjustment Location:

– Main board –



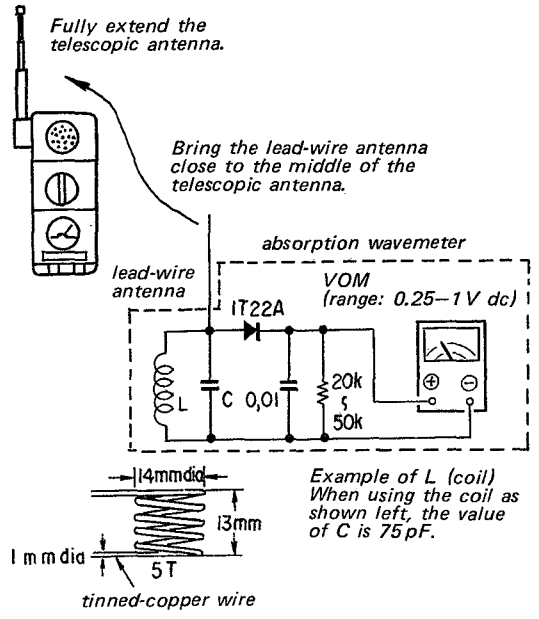
– Synthesizer board –



TX Loading Coil Adjustment

Procedure:

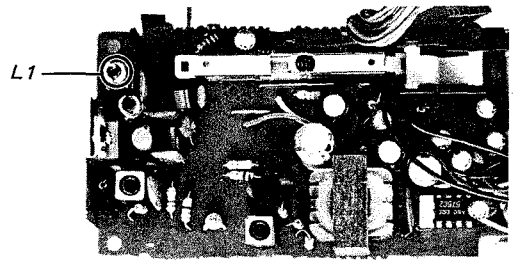
Mode: transmit (with no modulation)



Adjust L1 for a maximum reading on VOM.

Adjustment Location:

– Main board –



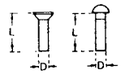
1/4 WATT CARBON RESISTORS

Ω	Part No.	Ω	Part No.	Ω	Part No.	Ω	Part No.	Ω	Part No.	Ω	Part No.	Ω	Part No.
1.0	1-246-401-00	10	1-246-425-00	100	1-246-449-00	1.0k	1-246-473-00	10k	1-246-497-00	100k	1-246-521-00	1.0M	1-246-545-00
1.1	1-246-402-00	11	1-246-426-00	110	1-246-450-00	1.1k	1-246-474-00	11k	1-246-498-00	110k	1-246-522-00	1.1M	1-210-814-00
1.2	1-246-403-00	12	1-246-427-00	120	1-246-451-00	1.2k	1-246-475-00	12k	1-246-499-00	120k	1-246-523-00	1.2M	1-210-815-00
1.3	1-246-404-00	13	1-246-428-00	130	1-246-452-00	1.3k	1-246-576-00	13k	1-246-500-00	130k	1-246-524-00	1.3M	1-210-816-00
1.5	1-246-405-00	15	1-246-429-00	150	1-246-453-00	1.5k	1-246-577-00	15k	1-246-501-00	150k	1-246-525-00	1.5M	1-210-817-00
1.6	1-246-406-00	16	1-246-430-00	160	1-246-454-00	1.6k	1-246-578-00	16k	1-246-502-00	160k	1-246-526-00	1.6M	1-210-818-00
1.8	1-246-407-00	18	1-246-431-00	180	1-246-455-00	1.8k	1-246-579-00	18k	1-246-503-00	180k	1-246-527-00	1.8M	1-210-819-00
2.0	1-246-408-00	20	1-246-432-00	200	1-246-456-00	2.0k	1-246-580-00	20k	1-246-504-00	200k	1-246-528-00	2.0M	1-210-820-00
2.2	1-246-409-00	22	1-246-433-00	220	1-246-457-00	2.2k	1-246-581-00	22k	1-246-505-00	220k	1-246-529-00	2.2M	1-210-821-00
2.4	1-246-410-00	24	1-246-434-00	240	1-246-458-00	2.4k	1-246-582-00	24k	1-246-506-00	240k	1-246-530-00	2.4M	1-244-754-00
2.7	1-246-411-00	27	1-246-435-00	270	1-246-459-00	2.7k	1-246-583-00	27k	1-246-507-00	270k	1-246-531-00	2.7M	1-244-755-00
3.0	1-246-412-00	30	1-246-436-00	300	1-246-460-00	3.0k	1-246-584-00	30k	1-246-508-00	300k	1-246-532-00	3.0M	1-244-756-00
3.3	1-246-413-00	33	1-246-437-00	330	1-246-461-00	3.3k	1-246-585-00	33k	1-246-509-00	330k	1-246-533-00	3.3M	1-244-757-00
3.6	1-246-414-00	36	1-246-438-00	360	1-246-462-00	3.6k	1-246-586-00	36k	1-246-510-00	360k	1-246-534-00	3.6M	1-244-758-00
3.9	1-246-415-00	39	1-246-439-00	390	1-246-463-00	3.9k	1-246-587-00	39k	1-246-511-00	390k	1-246-535-00	3.9M	1-244-759-00
4.3	1-246-416-00	43	1-246-440-00	430	1-246-464-00	4.3k	1-246-488-00	43k	1-246-512-00	430k	1-246-536-00	4.3M	1-244-760-00
4.7	1-246-417-00	47	1-246-441-00	470	1-246-465-00	4.7k	1-246-489-00	47k	1-246-513-00	470k	1-246-537-00	4.7M	1-244-761-00
5.1	1-246-418-00	51	1-246-442-00	510	1-246-466-00	5.1k	1-246-490-00	51k	1-246-514-00	510k	1-246-538-00	5.1M	1-244-762-00
5.6	1-246-419-00	56	1-246-443-00	560	1-246-467-00	5.6k	1-246-491-00	56k	1-246-515-00	560k	1-246-539-00		
6.2	1-246-420-00	62	1-246-444-00	620	1-246-468-00	6.2k	1-246-492-00	62k	1-246-516-00	620k	1-246-540-00		
6.8	1-246-421-00	68	1-246-445-00	680	1-246-469-00	6.8k	1-246-493-00	68k	1-246-517-00	680k	1-246-541-00		
7.5	1-246-422-00	75	1-246-446-00	750	1-246-470-00	7.5k	1-246-494-00	75k	1-246-518-00	750k	1-246-542-00		
8.2	1-246-423-00	82	1-246-447-00	820	1-246-471-00	8.2k	1-246-495-00	82k	1-246-519-00	820k	1-246-543-00		
9.1	1-246-424-00	91	1-246-448-00	910	1-246-472-00	9.1k	1-246-496-00	91k	1-246-520-00	910k	1-246-544-00		

HARDWARE NOMENCLATURE

Screw:

P 3 × 10
- *L: Length in mm*
- *D: Diameter in mm*
- *Type of head*
- *Indicated slotted-head only. Unless otherwise indicated, it means cross-recessed head (Phillips type).*



Nut, Washer, Retaining ring:

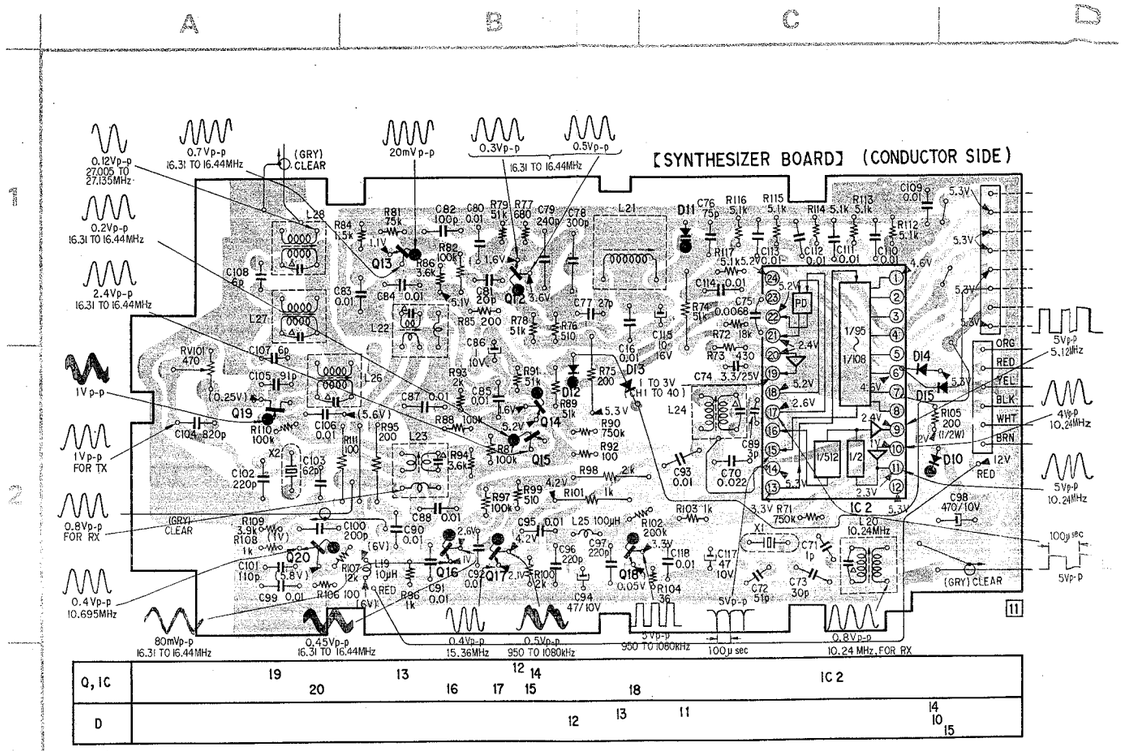
N 3
- *Diameter of usable screw or shaft*
- *Reference designation*

Reference Designation	Shape	Description	Remarks
SCREWS			
P		pan-head screw	binding-head (B) screw for replacement
PWH		pan-head screw with washer face	binding-head (B) screw and flat washer for replacement
PS PSP		pan-head screw with spring washer	binding-head (B) screw and spring washer for replacement
PSW PSPW		pan-head screw with spring and flat washers	binding-head (B) screw and spring and flat washers for replacement
R		round-head screw	binding-head (B) screw for replacement
K		flat-countersunk-head screw	
RK		oval-countersunk-head screw	
B		binding-head screw	
T		truss-head screw	binding-head (B) screw for replacement
F		flat-fillister-head screw	
RF		fillister-head screw	
BV		braizer-head screw	

Reference Designation	Shape	Description	Remarks
SELF-TAPPING SCREWS			
TA		self-tapping screw	ex: TA, P 3 x 10
PTP		pan-head self-tapping screw	binding-head self-tapping (TA, B) screw for replacement
PTPWH		pan-head self-tapping screw with washer face	binding-head self tapping (TA, B) screw and flat washer for replacement
PTTWH		pan-head thread-rolling screw with washer face	binding-head (B) screw and flat washer for replacement
SET SCREWS			
SC		set screw	
SC		hexagon-socket set screw	ex: SC 2.6 x 4, hexagon socket
NUT			
N		nut	
WASHERS			
W		flat washer	
SW		spring washer	
LW		internal-tooth lock washer	ex: LW3, internal
LW		external-tooth lock washer	ex: LW3, external
RETAINING RINGS			
E		retaining ring	
G		grip-type retaining ring	

4-1. MOUNTING DIAGRAM — Synthesizer Board —

— Conductor Side —

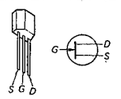


Q, IC	19	20	13	16	17	12	14	15	18	IC 2
D						12	13	11		14 10 15

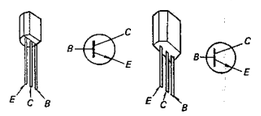
Replacement Semiconductors

For replacement, use semiconductors ‹cept in ( ).

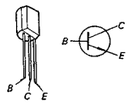
Q19: 2SK23A-923 (2SK23A)



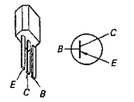
Q12: 2SC1364 (2SC633A)



Q13, Q15–18, Q20: 2SC710

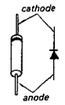


Q14: 2SA1027R

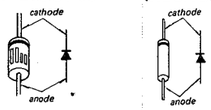


D12–16: 1S1555

D11: FC52C (FC52M)



D10: EQB01-05 (RD5.1E)

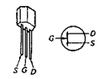


IC2: μPD861C

4-2. MOUNTING DIAGRAM

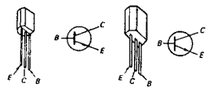
Replacement Semiconductors
For replacement, use semiconductors except in ( ).

Q1, 19: 2SK23A-923 (2SK23A)

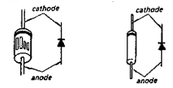


D1–4, D7–9, D12–15: 1S1555
D11: FC52C (FC52M)

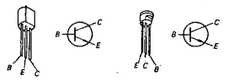
Q2, 7, 12: 2SC1364 (2SC633A)



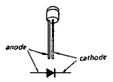
D5: EQB01-07 (RD6.2E)
D10: EQB01-05 (RD5.1E)



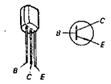
Q3: 2SC1129 (2SC668)



D6: TLR109

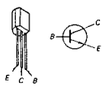


Q4–6, Q9, 13, Q15–18, Q20: 2SC710
Q10: 2SC773



IC1: μPC575C

Q8: 2SC1362



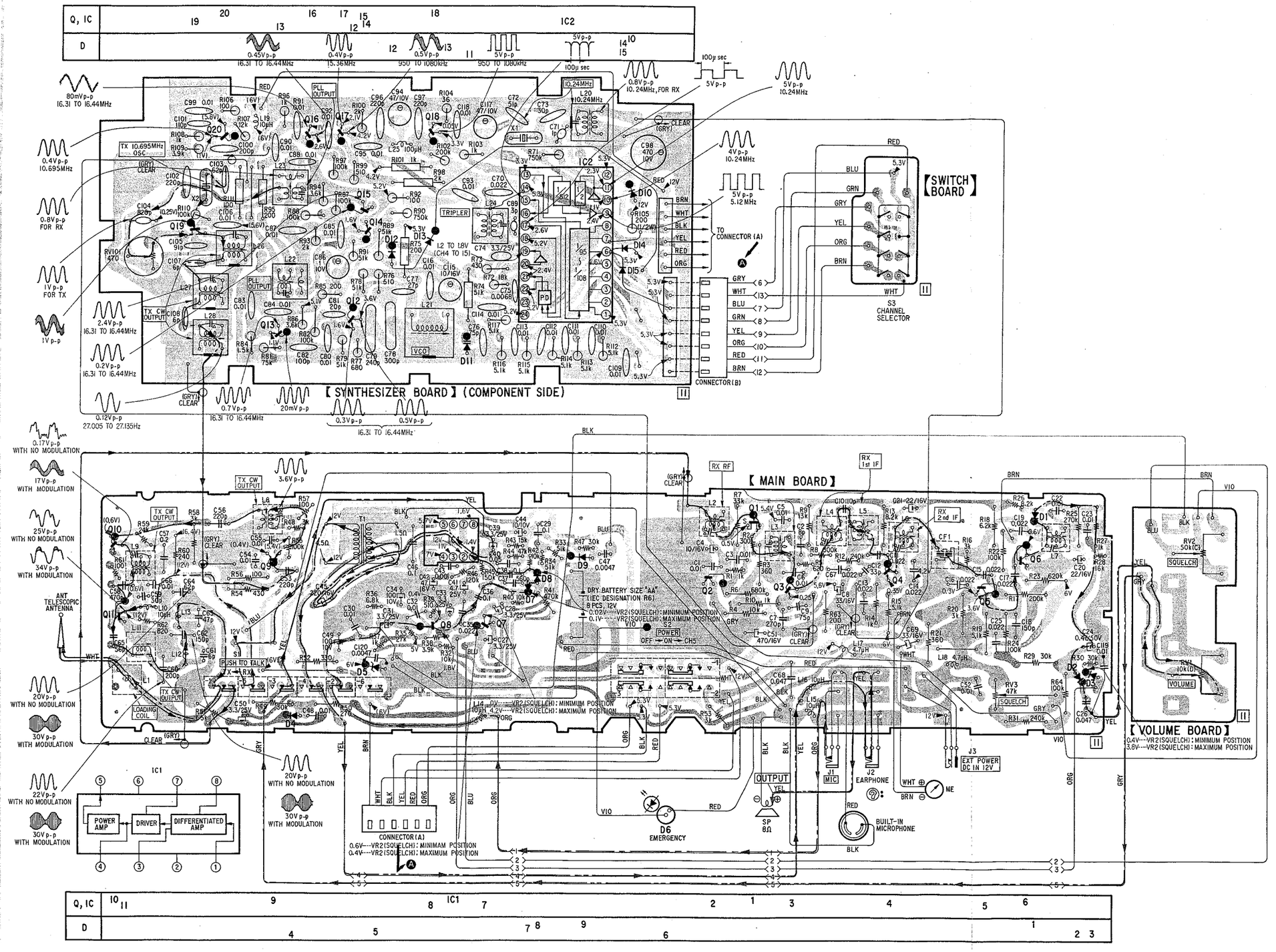
IC2: μPD861C

Q11: 2SC1760

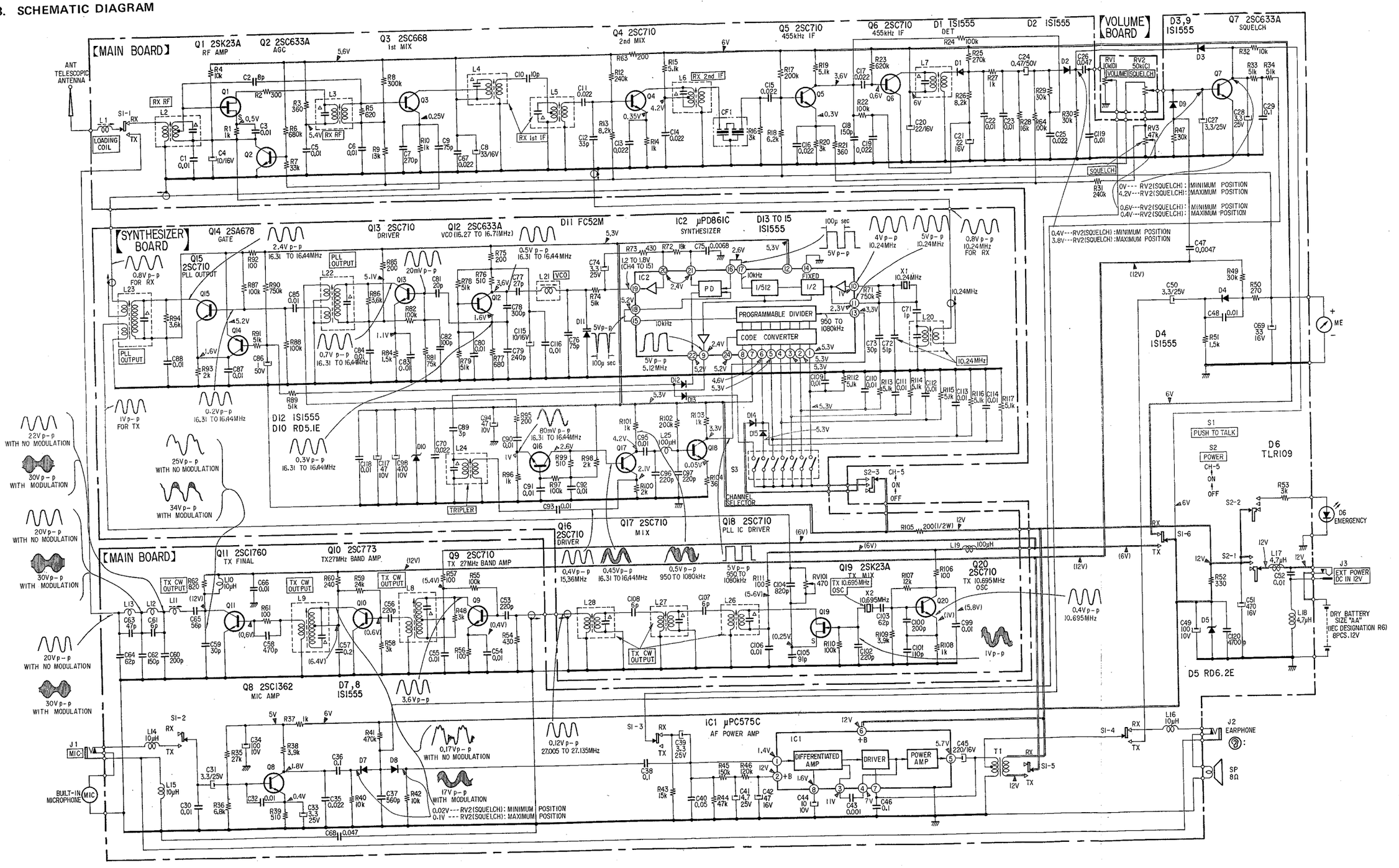
Q14: 2SA1027R (2SA678)

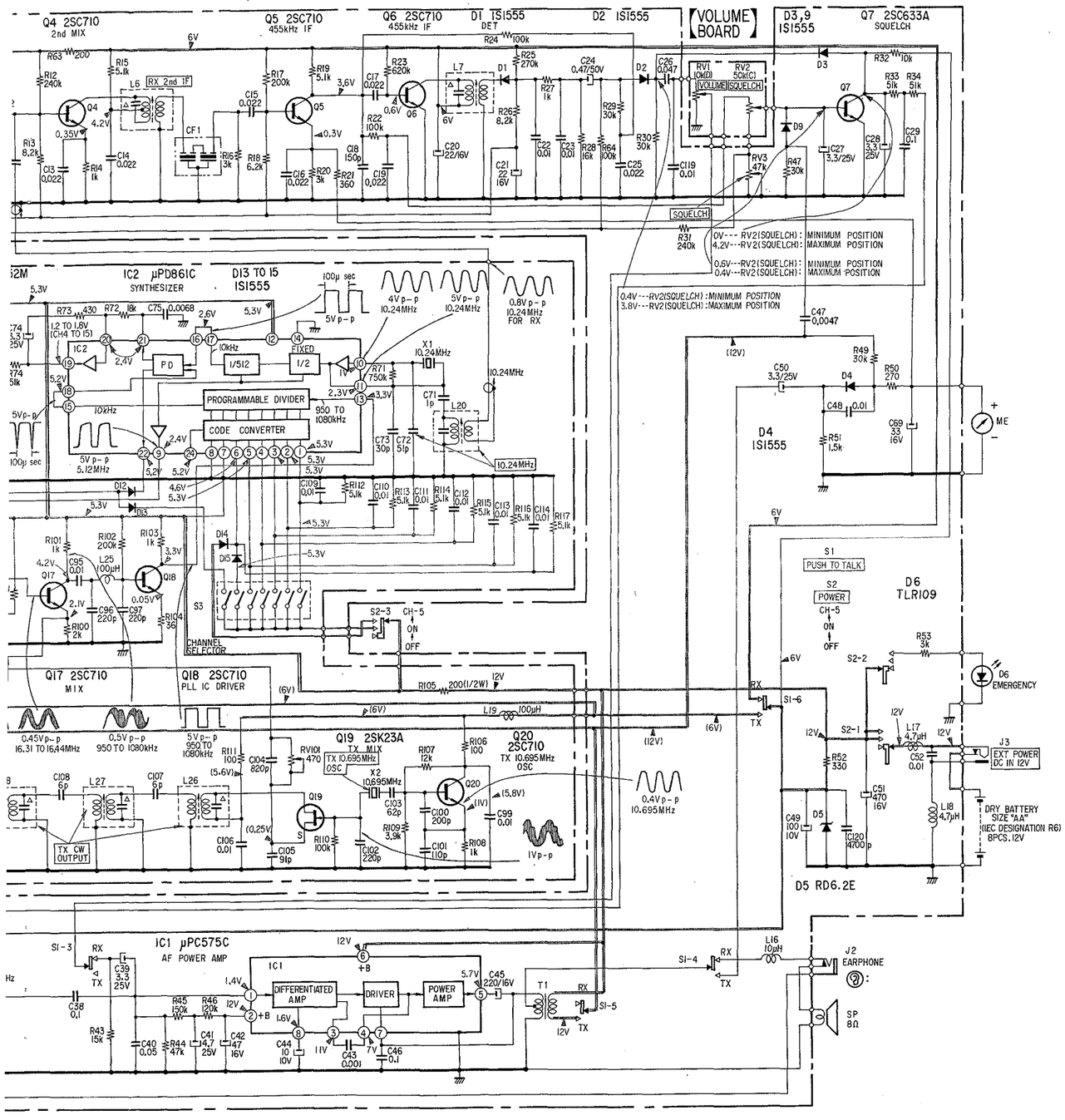
Note:

- [⊣ : indicates side identified with part number.
- ▨ : B+ pattern.
- Signal Path
  ▬▬▶ : TX
  ▬ ▬ ▶ : RX
- DC resistance measurements are with coils connected on the circuit board, and are approximate.
- ( ): TX
  no mark: RX



4-3. SCHEMATIC DIAGRAM





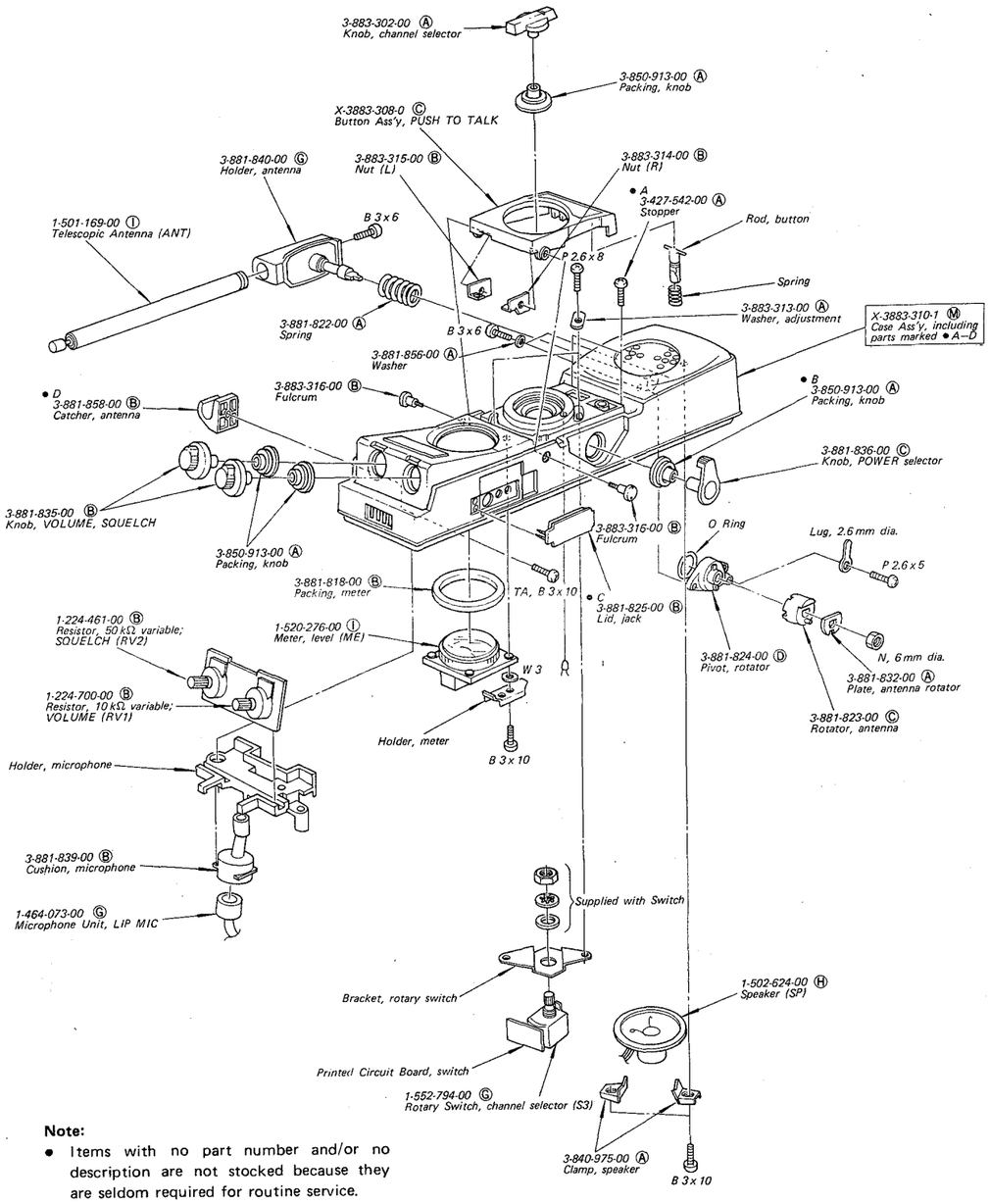
Note:

- TX: Transmitting
- RX: Receiving
- WITH MODULATION: 1 kHz, -60 dB signal is applied at J1 (MIC).
- All capacitors are in μF unless otherwise noted. pF = μμF 50WV or less are not indicated except for electrolytics.
- All resistors are in ohms, ¼W unless otherwise noted. kΩ = 1000Ω, MΩ = 1000 kΩ
- △: internal component.
- ——: B+ bus.
- ▭ : panel designation.
- ▭ : adjustment for repair.
- Voltages are dc with respect to ground unless otherwise noted.
- Readings are taken under no signal conditions with a VOM (20 kΩ/V).
  ( ): TX
  no mark: RX
- Transistor base-emitter voltages are measured on the 2.5V range.
- *Voltage variations may be noted due to normal production tolerances.*
- Switch

Ref. No.	Switch	Position
S1-1–6	PUSH TO TALK	RX
S2-1–3	POWER	OFF
S3	CHANNEL SELECTOR	CH4

SECTION 5
BLOCK DIAGRAM

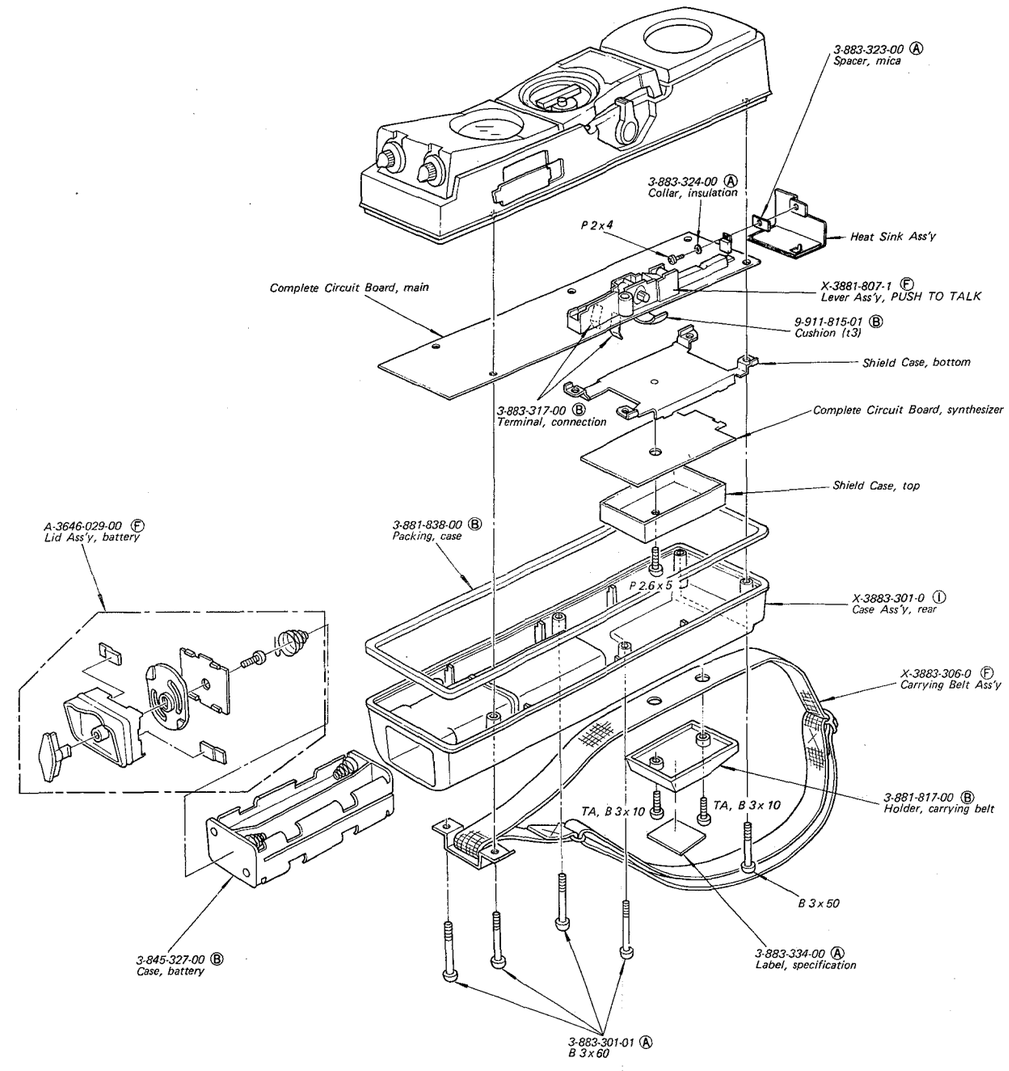
5-1.


3-883-302-00 Ⓐ Knob, channel selector
3-850-913-00 Ⓐ Packing, knob
X-3883-308-0 Ⓒ Button Ass'y, PUSH TO TALK
3-881-840-00 Ⓖ Holder, antenna
3-883-315-00 Ⓑ Nut (L)
3-883-314-00 Ⓑ Nut (R)
• A 3-427-542-00 Ⓐ Stopper
1-501-169-00 Ⓘ Telescopic Antenna (ANT)
B 3x6
P 2.6x8
Rod, button
Spring
3-881-822-00 Ⓐ Spring
3-883-313-00 Ⓐ Washer, adjustment
X-3883-310-1 Ⓜ Case Ass'y, including parts marked • A–D
3-881-856-00 Ⓐ Washer
• D 3-881-858-00 Ⓑ Catcher, antenna
3-883-316-00 Ⓑ Fulcrum
• B 3-850-913-00 Ⓐ Packing, knob
3-881-836-00 Ⓒ Knob, POWER selector
3-881-835-00 Ⓑ Knob, VOLUME, SQUELCH
3-850-913-00 Ⓐ Packing, knob
3-883-316-00 Ⓑ Fulcrum
O Ring
Lug, 2.6mm dia.
P 2.6x5
3-881-818-00 Ⓑ Packing, meter
TA, B 3x10
• C 3-881-825-00 Ⓑ Lid, jack
1-224-461-00 Ⓑ Resistor, 50 kΩ variable; SQUELCH (RV2)
1-520-276-00 Ⓘ Meter, level (ME)
3-881-824-00 Ⓓ Pivot, rotator
N, 6mm dia.
3-881-832-00 Ⓐ Plate, antenna rotator
3-881-823-00 Ⓒ Rotator, antenna
1-224-700-00 Ⓑ Resistor, 10 kΩ variable; VOLUME (RV1)
W 3
Holder, meter
B 3x10
Holder, microphone
3-881-839-00 Ⓑ Cushion, microphone
1-464-073-00 Ⓖ Microphone Unit, LIP MIC
Supplied with Switch
Bracket, rotary switch
1-502-624-00 Ⓗ Speaker (SP)
Printed Circuit Board, switch
1-552-794-00 Ⓖ Rotary Switch, channel selector (S3)
3-840-975-00 Ⓐ Clamp, speaker
B 3x10

Note:

- Items with no part number and/or no description are not stocked because they are seldom required for routine service.
- All screws are Phillips (cross recess) type unless otherwise noted.
  (–) = slotted head
- Circled letters (Ⓐ to Ⓩ) are applicable to European models only.

5-2.



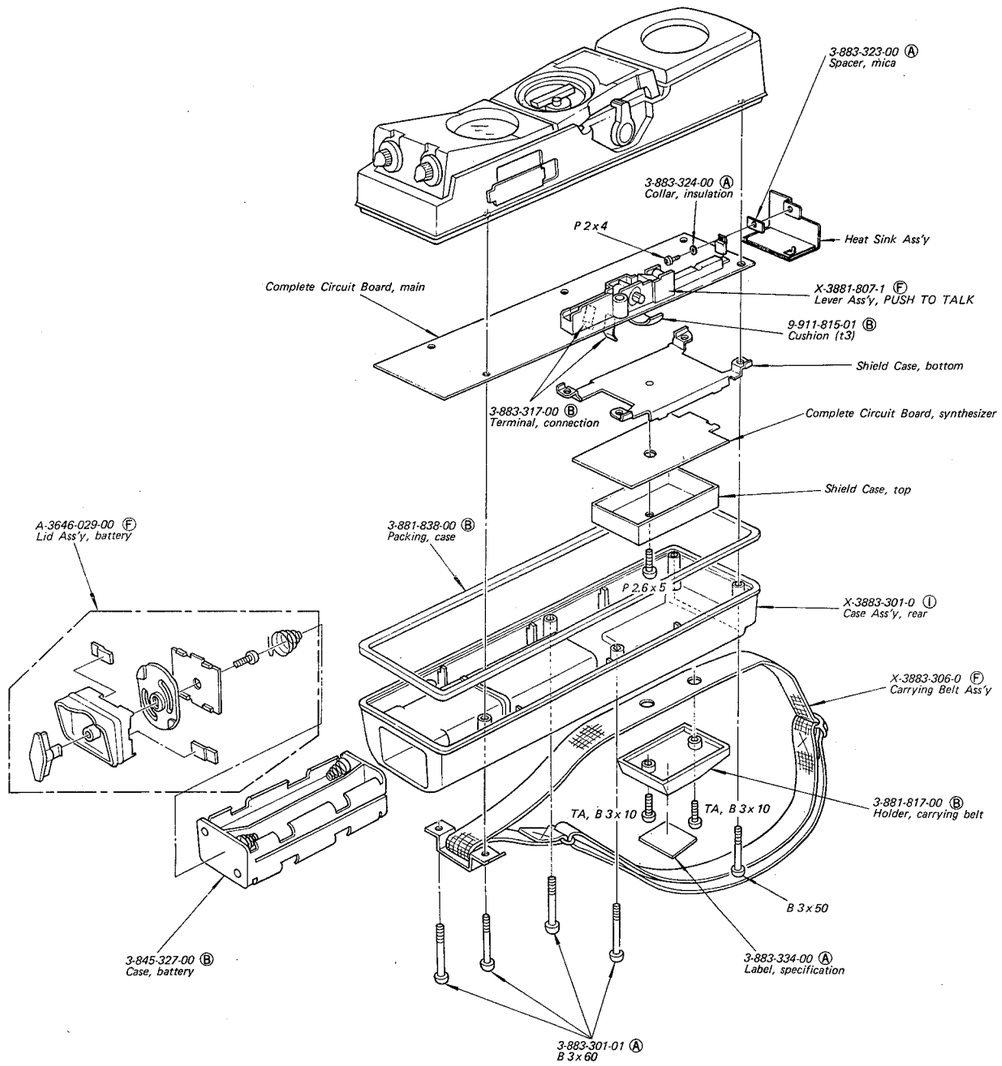
Note:

- Items with no part number and/or no description are not stocked because they are seldom required for routine service.
- All screws are Phillips (cross recess) type unless otherwise noted.
  (–) = slotted head
- Circled letters (Ⓐ to Ⓩ) are applicable to European models only.

Ref. N

⇒ Q1
⇒ Q2
⇒ Q3
Q4–6
⇒ Q7
Q8
Q9
Q10
Q11
⇒ Q12
Q13
⇒ Q14
Q15–1
⇒ Q19
Q20
IC
IC
D
⇒ D
D
D
⇒ D1
⇒ D1
D12–
L1
L2
L3
L4,5
L6
⇒: D
m

5-2.



Note:

- Items with no part number and/or no description are not stocked because they are seldom required for routine service.
- All screws are Phillips (cross recess) type unless otherwise noted.
  (–) = slotted head
- Circled letters (Ⓐ to Ⓩ) are applicable to European models only.

Note: Circled letters (Ⓐ to Ⓩ) are applicable to European models only.

SECTION 6
ELECTRICAL PARTS LIST

Ref. No.	*Part No.*	*Description*
		SEMICONDUCTORS
		Transistors
⇒Q1	8-722-392-03 Ⓒ	2SK23A-923
⇒Q2	8-729-663-47 Ⓑ	2SC1364
⇒Q3	8-725-923-00 Ⓑ	2SC1129
Q4–6	8-729-671-13 Ⓑ	2SC710
⇒Q7	8-729-663-47 Ⓑ	2SC1364
Q8	8-729-665-47 Ⓑ	2SC1362
Q9	8-729-671-13 Ⓑ	2SC710
Q10	8-729-677-31 Ⓑ	2SC773
Q11	8-763-314-00 Ⓒ	2SC1760
⇒Q12	8-729-663-47 Ⓑ	2SC1364
Q13	8-729-671-13 Ⓑ	2SC710
⇒Q14	8-729-612-77 Ⓑ	2SA1027R
Q15–18	8-729-671-13 Ⓑ	2SC710
⇒Q19	8-722-392-03 Ⓒ	2SK23A-923
Q20	8-729-671-13 Ⓑ	2SC710
		ICs
IC1	8-759-157-52 Ⓔ	μPC575C
IC2	8-759-186-11 Ⓜ	μPD861C
		Diodes
D1–4	8-719-815-55 Ⓐ	1S1555
⇒D5	8-719-931-07 Ⓑ	EQB01-07
D6	8-719-801-09 Ⓑ	TLR109
D7–9	8-719-815-55 Ⓐ	1S1555
⇒D10	8-719-931-05 Ⓑ	EQB01-05
⇒D11	8-719-900-50 Ⓕ	FC52C
D12–15	8-719-815-55 Ⓐ	1S1555
		COILS
L1	1-459-188-00 Ⓑ	Core Type
L2	1-401-384-00 Ⓑ	Antenna
L3	1-425-374-00 Ⓑ	FM RF
L4,5	1-403-243-00 Ⓑ	FM IFT
L6	1-403-110-15 Ⓑ	IFT

⇒: Due to standardization, interchangeable replacements may be substituted for parts specified in the diagrams.

Ref. No.	*Part No.*	*Description*
L7	1-403-137-00 Ⓑ	IFT, detector
L8,9	1-425-744-00 Ⓒ	RF
L10	1-407-157-XX Ⓐ	Microinductor, 10μH
L11	1-425-627-00 Ⓑ	FM RF
L14–16	1-407-157-XX Ⓐ	Microinductor, 10μH
L17,18	1-407-186-XX Ⓐ	Microinductor, 4.7μH
L19	1-407-157-XX Ⓐ	Microinductor, 10μH
L20	1-403-243-00 Ⓑ	FM IFT
L21	1-405-754-00 Ⓑ	Osc
L22,23	1-425-947-00 Ⓑ	Output
L24	1-425-946-00 Ⓑ	Output
L25	1-407-169-XX Ⓐ	Microinductor, 100μH
L26–28	1-425-374-00 Ⓑ	FM RF

CAPACITORS

All capacitors are in μF and ceramic unless otherwise noted.
50WV or less are not indicated except for electrolytics. pF: μμF, elect: electrolytic

C1	1-161-013-00 Ⓐ	0.01		(Semiconductor)
C2	1-102-945-00 Ⓐ	8p		
C3	1-161-013-00 Ⓐ	0.01		(Semiconductor)
C4	1-121-651-00 Ⓐ	10	16V	elect
C5,6	1-161-013-00 Ⓐ	0.01		(Semiconductor)
C7	1-102-111-00 Ⓐ	270p		
C8	1-121-403-00 Ⓐ	33	16V	elect
C9	1-101-890-00 Ⓐ	75p		
C10	1-102-947-00 Ⓐ	10p		
C11	1-161-034-00 Ⓐ	0.022		(Semiconductor)
C12	1-102-963-00 Ⓐ	33p		
C13,14	1-161-034-00 Ⓐ	0.022		(Semiconductor)
C15	1-101-005-00 Ⓐ	0.022		
C16	1-161-034-00 Ⓐ	0.022		(Semiconductor)
C17	1-101-005-00 Ⓐ	0.022		
C18	1-101-361-00 Ⓐ	150p		
C19	1-101-005-00 Ⓐ	0.022		
C20,21	1-121-479-00 Ⓐ	22	16V	elect
C22,23	1-101-004-00 Ⓐ	0.01		

Note: Circled letters (Ⓐ to Ⓩ) are applicable to European models only.

Ref. No.	Part No.		Description		
C24	1-121-726-00	Ⓐ	0.47	50V	elect
C25	1-101-005-00	Ⓐ	0.022		
C26	1-161-036-00	Ⓐ	0.047		(Semiconductor)
C27,28	1-121-392-00	Ⓐ	3.3	25V	elect
C29	1-131-341-00	Ⓑ	0.1		aluminum
C30	1-101-004-00	Ⓐ	0.01		
C31	1-121-392-00	Ⓐ	3.3	25V	elect
C32	1-101-004-00	Ⓐ	0.01		
C33	1-121-392-00	Ⓐ	3.3	25V	elect
C34	1-121-414-00	Ⓐ	100	10V	elect
C35	1-101-005-00	Ⓐ	0.022		
C36	1-101-797-00	Ⓐ	0.1		
C37	1-102-115-00	Ⓐ	560p		
C38	1-101-797-00	Ⓐ	0.1		
C39	1-121-392-00	Ⓐ	3.3	25V	elect
C40	1-101-796-00	Ⓐ	0.05		
C41	1-121-395-00	Ⓐ	4.7	25V	elect
C42	1-121-409-00	Ⓐ	47	16V	elect
C43	1-161-026-00	Ⓐ	0.001		
C44	1-131-228-00	Ⓑ	10	10V	tantalum
C45	1-131-421-00	Ⓑ	220	16V	tantalum
C46	1-161-025-00	Ⓐ	0.1		(Semiconductor)
C47	1-161-030-00	Ⓐ	0.0047		
C48	1-101-004-00	Ⓐ	0.01		
C49	1-121-414-00	Ⓐ	100	10V	elect
C50	1-121-392-00	Ⓐ	3.3	25V	elect
C51	1-121-426-00	Ⓑ	470	16V	
C52	1-101-004-00	Ⓐ	0.01		
C53	1-102-110-00	Ⓐ	220p		
C54,55	1-161-013-00	Ⓐ	0.01		(Semiconductor)
C56	1-102-110-00	Ⓐ	220p		
C57	1-101-798-00	Ⓑ	0.2		
C58	1-102-823-00	Ⓐ	470p		
C59	1-102-962-00	Ⓐ	30p		
C60	1-107-092-00	Ⓐ	200p		silvered mica
C61	1-107-103-00	Ⓐ	6p		silvered mica
C62	1-107-089-00	Ⓐ	150p		silvered mica
C63	1-107-007-00	Ⓐ	47p		silvered mica
C64	1-107-080-00	Ⓐ	62p		silvered mica
C65	1-101-884-00	Ⓐ	56p		

Ref. No.	Part No.		Description		
C66	1-161-013-00	Ⓐ	0.01		(Semiconductor)
C67	1-101-005-00	Ⓐ	0.022		
C68	1-101-006-00	Ⓐ	0.047		
C69	1-121-403-00	Ⓐ	33	16V	elect
C70	1-101-005-00	Ⓐ	0.022		
C71	1-102-934-00	Ⓐ	1p		
※C72	1-107-075-00	Ⓐ	39p		silvered mica
	1-107-076-00	Ⓐ	43p		silvered mica
	1-107-077-00	Ⓐ	47p		silvered mica
	1-107-078-00	Ⓐ	51p		silvered mica
	1-107-079-00	Ⓐ	56p		silvered mica
C73	1-107-072-00	Ⓐ	30p		silvered mica
C74	1-131-218-00	Ⓑ	3.3	25V	tantalum
C75	1-161-069-00	Ⓐ	0.0068		(Semiconductor)
C76	1-102-761-00	Ⓐ	75p		
C77	1-102-883-00	Ⓐ	27p		
C78	1-107-096-00	Ⓐ	300p		silvered mica
C79	1-107-094-00	Ⓐ	240p		silvered mica
C80	1-101-004-00	Ⓐ	0.01		
C81	1-102-958-00	Ⓐ	20p		
C82	1-102-973-00	Ⓐ	100p		
C83–85	1-101-004-00	Ⓐ	0.01		
C86	1-121-391-00	Ⓐ	1	50V	elect
C87	1-161-070-00	Ⓐ	0.01		(Semiconductor)
C88	1-101-004-00	Ⓐ	0.01		
C89	1-102-936-00	Ⓐ	3p		
C90–93	1-101-004-00	Ⓐ	0.01		
C94	1-121-352-00	Ⓐ	47	10V	elect
C95	1-101-004-00	Ⓐ	0.01		
C96,97	1-102-978-00	Ⓐ	220p		
C98	1-121-425-00	Ⓑ	470	10V	elect
C99	1-101-004-00	Ⓐ	0.01		
C100	1-107-092-00	Ⓐ	200p		silvered mica
C101	1-107-086-00	Ⓐ	110p		silvered mica
C102	1-107-093-00	Ⓐ	220p		silvered mica
※C103	1-107-192-00	Ⓐ	51p		silvered mica
	1-107-056-00	Ⓐ	56p		silvered mica
	1-107-193-00	Ⓐ	62p		silvered mica
	1-107-034-00	Ⓐ	68p		silvered mica
	1-107-003-00	Ⓐ	75p		silvered mica

※ : C72 10.24 MHz adjustment
C103 TX 10.695 MHz osc adjustment

1. PLL SYNTHESIZER CIRCUIT OPERATION

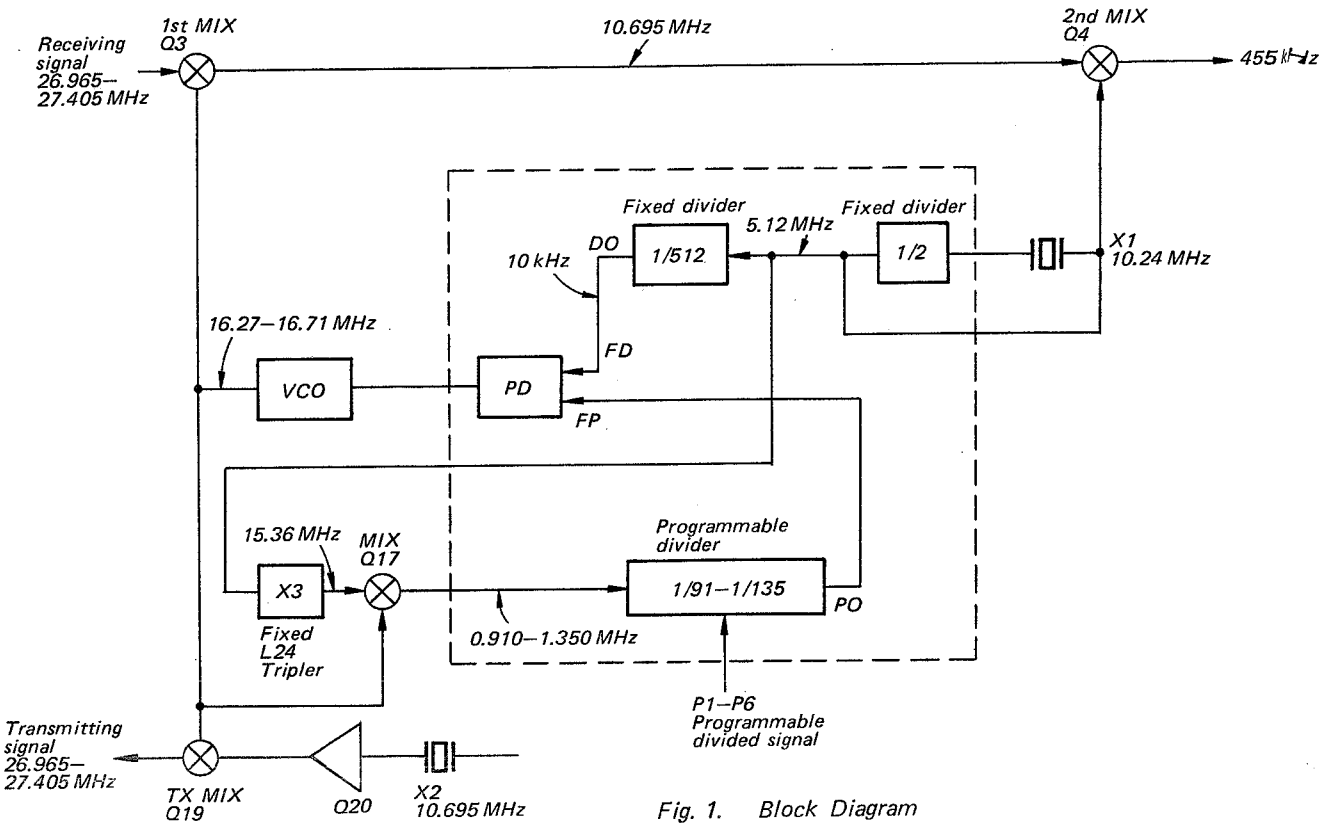


Fig. 1. Block Diagram

As shown in Fig. 1, the frequency of the VCO (Voltage Controlled Oscillator) is varied between 16.27–16.71 MHz (CH1–40) in 10 kHz steps according to the position of the channel selector. The output of the VCO goes to the PD via Q17 and the programmable divider and is compared with the 10 kHz reference signal which is obtained by dividing the 10.24 MHz signal from X1. The PD detects a phase difference between the output of the VCO and the 10 kHz reference signal, so that the oscillation frequency of the VCO is maintained at constant frequency. This system is called a PLL (Phase Locked Loop), and is a type of frequency synthesizer.

(1) Reference Frequency

The 10 kHz signal from the DO (Divider Output) is the reference signal since it is closely related to the 10 kHz steps of the transmitting and receiving signals. The 10.24 MHz signal from X1 is converted to a 10 kHz signal by the $1/2$ and $1/512$ fixed dividers.

(2) Second Local Oscillator Signal

This set uses a double superheterodyne circuit. The second i-f is 455 kHz. The first i-f is about 10 MHz for better image rejection. Because of this, the 10.24 MHz of X1 can be used as the second local oscillator frequency. As a result, the first i-f is 10.695 MHz (455 kHz + 10.24 MHz).

(3) First Local Oscillator Signal

Since the second local oscillator is fixed in frequency, the receiving frequency is controlled in 10 kHz steps by the first local oscillator. The signal of the first local oscillator comes from the VCO and is controlled by the PLL frequency synthesizer. The frequency of the VCO is 16.27–16.71 MHz which is lower than the receiving frequency by the amount of the first i-f.

(4) VCO Scaling

To supply about a 1 MHz input to the programmable divider, the output of the VCO is lowered by the use of Q17 (MIXER). Here, if the input from the VCO is in the 16 MHz band, the local oscillator signal must be in the 15 MHz band. To obtain the signal, the 10.24 MHz signal from X1 is divided by the ½ fixed divider and then is converted to the 15.36 MHz signal (the third harmonic) by the L24 (TRIPLER).

For example, when the VCO oscillates at 16.27 MHz, the output of the VCO is mixed with the 15.36 MHz signal, and then the 910 kHz difference signal comes on as the input to the programmable divider.

CITIZENS BAND TRANSCEIVER

ICB-1020

US Model

No. 1
March, 1978

SUPPLEMENT

File this supplement with the service manual.

Subject: Circuit Operation

TABLE OF CONTENTS

	Description	*Page*
1.	PLL SYNTHESIZER CIRCUIT OPERATION	2
2.	PROGRAMMABLE DIVIDER	3
3.	PHASE DETECTOR	6

SONY®
SERVICE MANUAL

1. PLL SYNTHESIZER CIRCUIT OPERATION

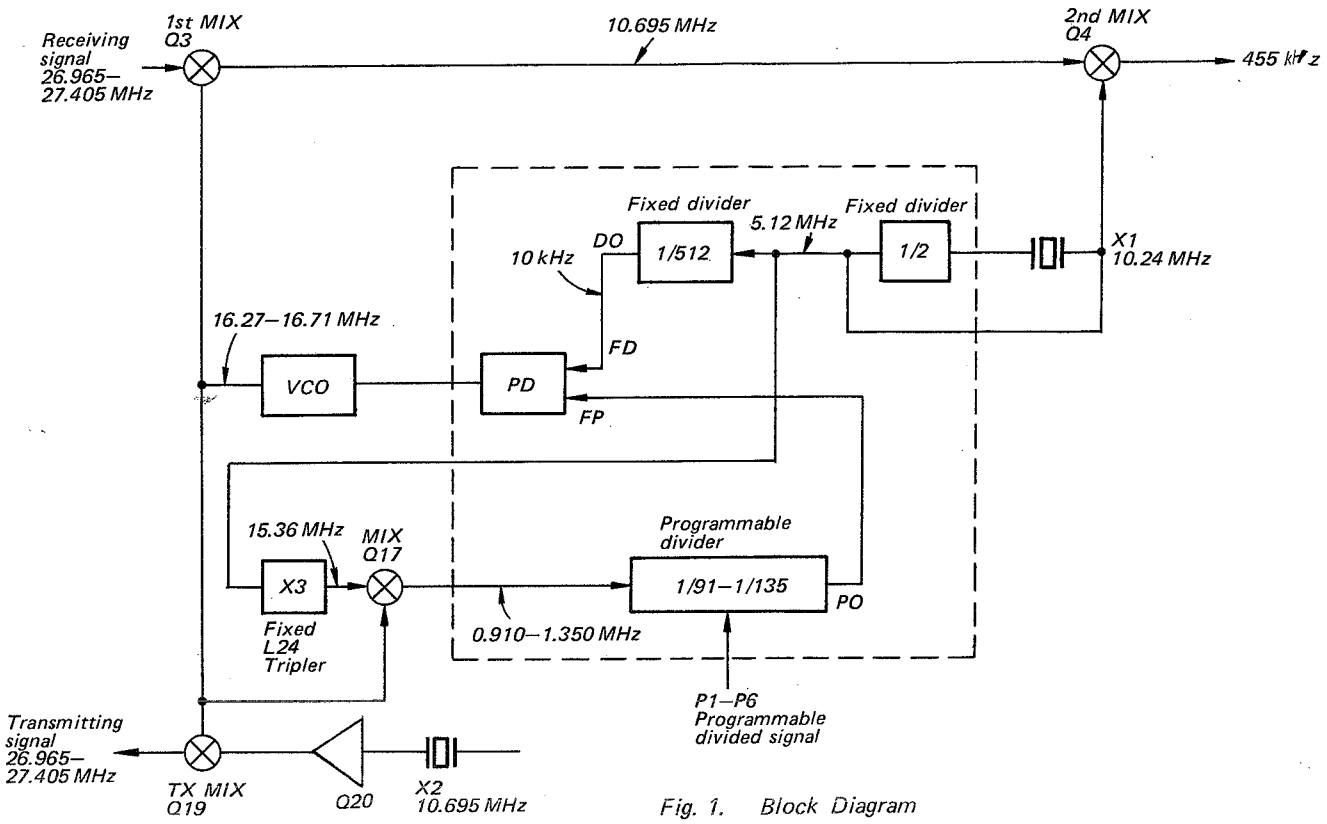


Fig. 1. Block Diagram

As shown in Fig. 1, the frequency of the VCO (Voltage Controlled Oscillator) is varied between 16.27–16.71 MHz (CH1–40) in 10 kHz steps according to the position of the channel selector. The output of the VCO goes to the PD via Q17 and the programmable divider and is compared with the 10 kHz reference signal which is obtained by dividing the 10.24 MHz signal from X1. The PD detects a phase difference between the output of the VCO and the 10 kHz reference signal, so that the oscillation frequency of the VCO is maintained at constant frequency. This system is called a PLL (Phase Locked Loop), and is a type of frequency synthesizer.

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Since the second local oscillator is fixed in frequency, the receiving frequency is controlled in 10 kHz steps by the first local oscillator. The signal of the first local oscillator comes from the VCO and is controlled by the PLL frequency synthesizer. The frequency of the VCO is 16.27–16.71 MHz which is lower than the receiving frequency by the amount of the first i-f.

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To supply about a 1 MHz input to the programmable divider, the output of the VCO is lowered by the use of Q17 (MIXER). Here, if the input from the VCO is in the 16 MHz band, the local oscillator signal must be in the 15 MHz band. To obtain the signal, the 10.24 MHz signal from X1 is divided by the ½ fixed divider and then is converted to the 15.36 MHz signal (the third harmonic) by the L24 (TRIPLER).

For example, when the VCO oscillates at 16.27 MHz, the output of the VCO is mixed with the 15.36 MHz signal, and then the 910 kHz difference signal comes on as the input to the programmable divider.

2. PROGRAMMABLE DIVIDER

The signal from Q17 (MIXER) is converted to a 10 kHz signal by the programmable divider. The phase of the 10 kHz signal is compared with that of the reference signal at the PD (Phase Detector). Here, the frequency of the signal from Q17 (MIXER) is 0.91–1.35 MHz, because the VCO oscillates at 16.27–16.71 MHz and the frequency of the signal from the L24 (TRIPLER) is 15.36 MHz. Therefore, the dividing ratio to obtain the 10 kHz signal is $1/91 - 1/135$ and N of the programmable divider must be set to 91–135.

(1) Step of N

This section explains the N of the programmable divider by comparing the two frequencies of CH1 and CH2.

Here,

	VCO freq.–Freq. of the signal at L24 (tripler)	N of the programmable divider
CH1	16.27 MHz–15.36 MHz = 910 kHz	N = 910 kHz/10 kHz = 91
CH2	16.28 MHz–15.36 MHz = 920 kHz	N = 920 kHz/10 kHz = 92

This means that the frequency of the VCO varies in 10 kHz steps according to the setting of N.

(2) Setting of N

91–135 should be set as N of the programmable divider. However, since there is a programmable converter in the IC2, N can be set by the CH numbers. The CH numbers are inputted by using the BCD (Binary-Coded Decimal) which depends on the LOW or HIGH dc level applied to terminals P1–P6 of IC2.

Note: Positive logic is used.
1 = HIGH level
0 = LOW level

Table 1. Value of N (input/output frequency ratio of the divider) versus channel No.

CH No.	Transmitting receiving frequency (MHz)	VCO frequency 10.695 MHz lowered (MHz)	Divider input frequency lowered by heterodyne (kHz)	N or programmable divider	CH No.	Transmitting receiving frequency (MHz)	VCO frequency 10.695 MHz lowered (MHz)	Divider input frequency lowered by heterodyne (kHz)	N or programmable divider
1	26.965	16.270	910	91	21	27.215	16.520	1,160	116
2	26.975	16.280	920	92	22	27.225	16.530	1,170	117
3	26.985	16.290	930	93	23	27.255	16.560	1,200	120
4	27.005	16.310	950	95	24	27.235	16.540	1,180	118
5	27.015	16.320	960	96	25	27.245	16.550	1,190	119
6	27.025	16.330	970	97	26	27.265	16.570	1,210	121
7	27.035	16.340	980	98	27	27.275	16.580	1,220	122
8	27.055	16.360	1,000	100	28	27.285	16.590	1,230	123
9	27.065	16.370	1,010	101	29	27.295	16.600	1,240	124
10	27.075	16.380	1,020	102	30	27.305	16.610	1,250	125
11	27.085	16.390	1,030	103	31	27.315	16.620	1,260	126
12	27.105	16.410	1,050	105	32	27.325	16.630	1,270	127
13	27.115	16.420	1,060	106	33	27.335	16.640	1,280	128
14	27.125	16.430	1,070	107	34	27.345	16.650	1,290	129
15	27.135	16.440	1,080	108	35	27.355	16.660	1,300	130
16	27.155	16.460	1,100	110	36	27.365	16.670	1,310	131
17	27.165	16.470	1,110	111	37	27.375	16.680	1,320	132
18	27.175	16.480	1,120	112	38	27.385	16.690	1,330	133
19	27.185	16.490	1,130	113	39	27.395	16.700	1,340	134
20	27.205	16.510	1,150	115	40	27.405	16.710	1,350	135

Note: The i-f frequency is 10.695 MHz.
The frequency of the L24 (TRIPLER) is 15.36 MHz.
It is not always applicable in the Table 1 that N – CH No. = 90.
This is because there are blanks and frequencies having a special arrangement within the citizen band channels.

(3) Channel Display and Program Code Table

The program input of μPD861C is the CH No. input at terminals P1–P8 in BCD code. Furthermore, the terminal M is maintained at a HIGH level at this time, and the operation is as shown below,

1. INPUT is received in BCD code.
2. Offset 90 is performed.

Note: BCD: Binary-Coded Decimal

Table 2. Channel display and program code

CH No.	(Pin 1) P1	(Pin 2) P2	(Pin 3) P3	(Pin 4) P4	(Pin 5) P5	(Pin 6) P6	CH No.	(Pin 1) P1	(Pin 2) P2	(Pin 3) P3	(Pin 4) P4	(Pin 5) P5	(Pin 6) P6
1	1	0	0	0	0	0	21	1	0	0	0	0	1
2	0	1	0	0	0	0	22	0	1	0	0	0	1
3	1	1	0	0	0	0	23	1	1	0	0	0	1
4	0	0	1	0	0	0	24	0	0	1	0	0	1
5	1	0	1	0	0	0	25	1	0	1	0	0	1
6	0	1	1	0	0	0	26	0	1	1	0	0	1
7	1	1	1	0	0	0	27	1	1	1	0	0	1
8	0	0	0	1	0	0	28	0	0	0	1	0	1
9	1	0	0	1	0	0	29	1	0	0	1	0	1
10	0	0	0	0	1	0	30	0	0	0	0	1	1
11	1	0	0	0	1	0	31	1	0	0	0	1	1
12	0	1	0	0	1	0	32	0	1	0	0	1	1
13	1	1	0	0	1	0	33	1	1	0	0	1	1
14	0	0	1	0	1	0	34	0	0	1	0	1	1
15	1	0	1	0	1	0	35	1	0	1	0	1	1
16	0	1	1	0	1	0	36	0	1	1	0	1	1
17	1	1	1	0	1	0	37	1	1	1	0	1	1
18	0	0	0	1	1	0	38	0	0	0	1	1	1
19	1	0	0	1	1	0	39	1	0	0	1	1	1
20	0	0	0	0	0	1	40	0	0	0	0	0	0

Note: ○ All zero is programmed in only at CH40. ○ 1 = + level (HIGH).
○ 0 = GND level (LOW). ○ P7 and P8 are always hold at 0 and therefore not indicated.

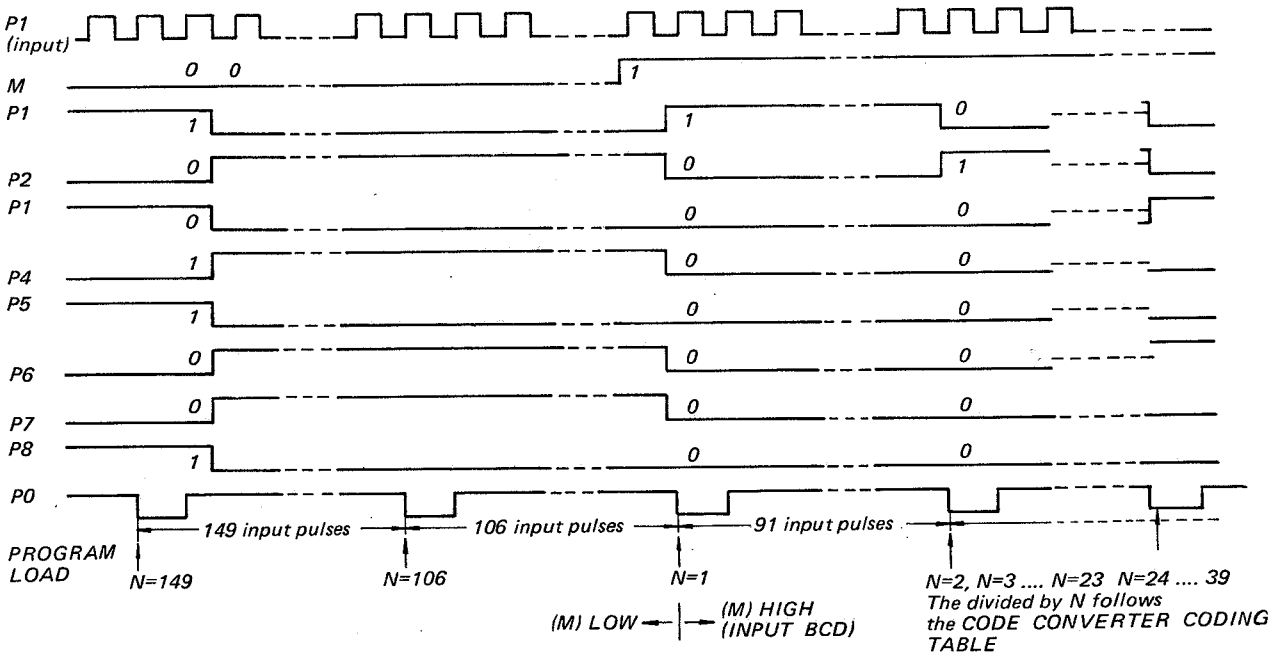

Fig. 2. Timing diagram of the programmable divider section

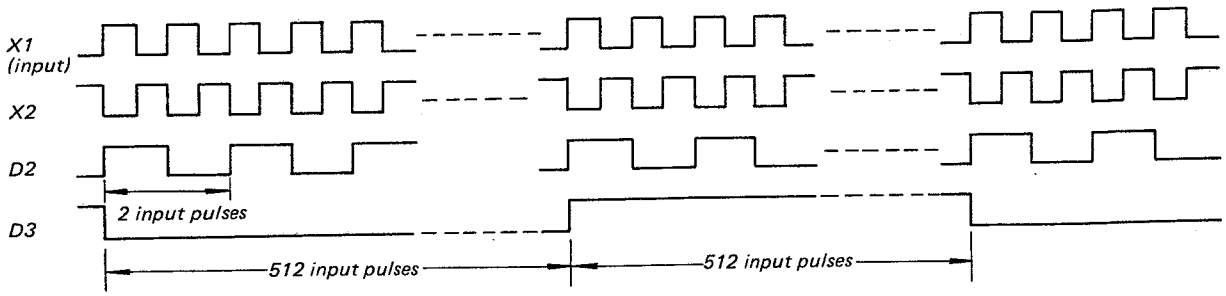

Fig. 3. Timing diagram of the divider section

3. PHASE DETECTOR

The block diagram of the phase detector is shown below.

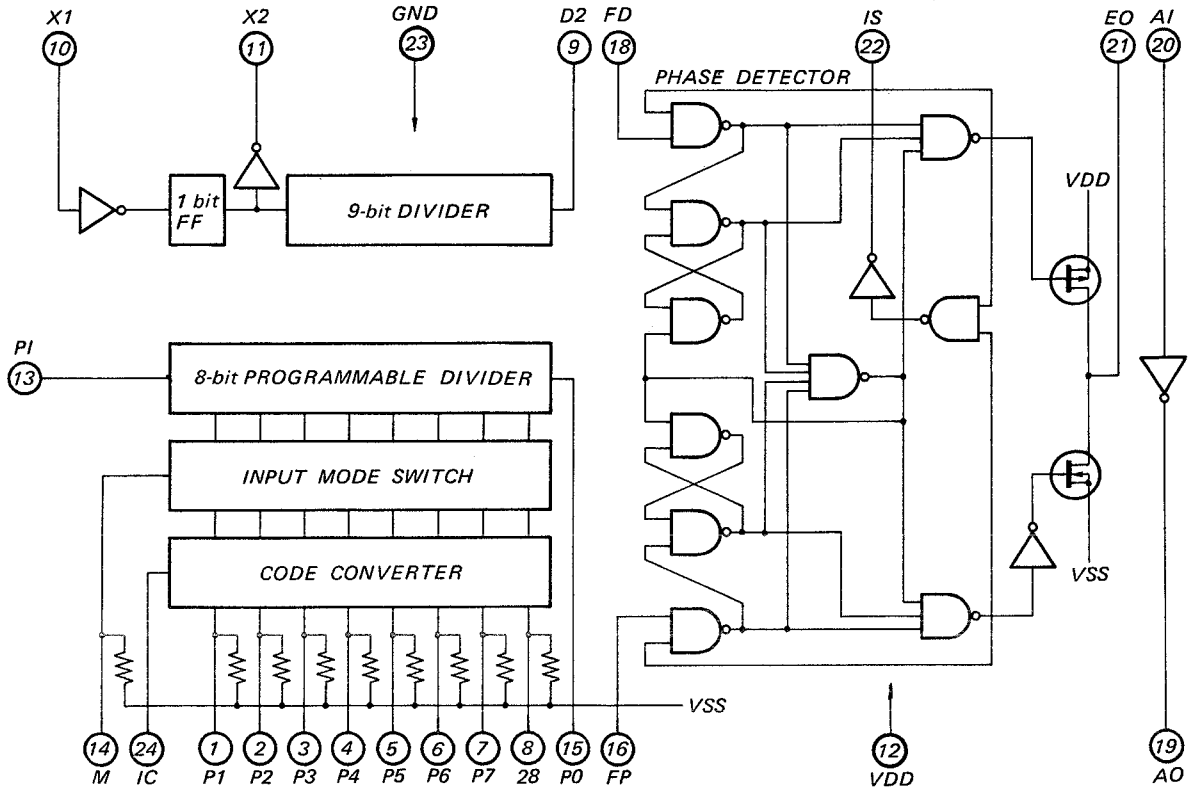

Fig. 4. Block diagram

As shown in Fig. 4, the phase detector is a digital circuit consisting of a combination of gates. This circuit contains a block which compares the phases of inputs FD and FP and a charge pump which sends out the result of this comparison. Phase comparison is performed at the rising edges of the input pulses.

As illustrated in Fig. 5, if the phase of FP leads the phase of FD, the output becomes HIGH (1) level. If the phase of FP lags the phase of FD, the output becomes LOW (0) level. If the two inputs are in phase, the impedance of the charge pump output becomes high. As a result, a phase difference between the two inputs is detected as shown in Fig. 6.

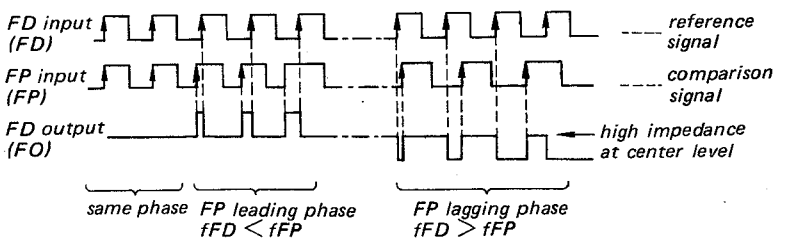

Fig. 5. FD output

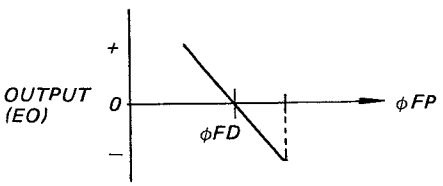

Fig. 6. Charge pump output

(1) Charge Pump

The output pulse from the phase detector is converted to dc by the charge pump. The charge pump is a push-pull circuit using a CMOS (Complementary MOS) and an inverter added to the gate of the N-MOS.

(a) When D is 1 and P is 0

A positive voltage is applied to Q2 (N-MOS) by the inverter, Q2 turns on and C is discharged.

(b) When D is 0 and P is 1

Q1 (P-MOS) turns on and C is charged.

(c) When both D and P are 1

Both Q1 and Q2 turn off, and EO is floating and the charging voltage of C is hold at this time. This hold time is inversely proportional to the gate leakage current of Q1 and Q2. When the hold time is made longer, EO can be maintained at a fixed frequency for a long time.

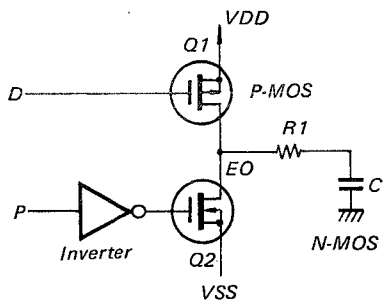

Fig. 7. Charge pump

(2) IS (Unlock stop)

The inputs from D and P of the charge pump appear as output IS through an AND circuit. If the AND is considered to be two diodes as shown in Fig. 8, its operation is as shown in Table 3.

That is, the output is 1 only when both D and P are 1. Since D and P become 1 when the PLL is locked, a signal for transmitting or receiving is supplied as output at this time.

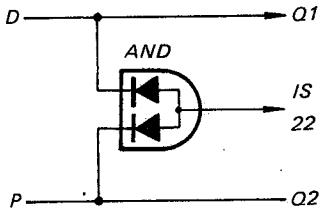

Fig. 8. AND circuit

Table 3. IS output

Input (D)	Input (P)	Output (IS)
0	0	0
0	1	0
1	0	0
1	1	1

Fig. 9 shows the actual IS circuit. Since the output of the PLL oscillator is passed through Q15 for both receiving and transmitting, if Q15 is not operated, transmitting and receiving are also stopped.

Usually, Q15 is operated by the bias VB (F) through R87. On the other hand, a VB (R) close to B+ is supplied to the base of Q14 through R90 and Q14 is cut off. Since the IS terminal is also 1, D12 is cut off.

When the unlock stop signal 0 appears at the IS terminal, the base current of Q14 flows through D12, Q14 turns on and the emitter of Q15 and the B+ bus are connected. This cuts off Q15.

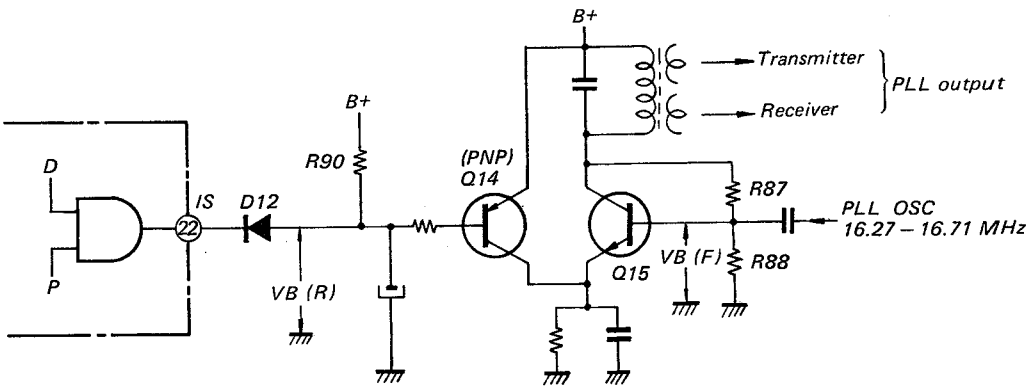

Fig. 9. Operation of IS signal

(3) Active Filter and VCO Connection

The active filter (LPF) primarily consists of R1 and CF to make a 6 dB/oct curve, and the negative feedback from CF extends the linear range of the frequency response curve shown in Fig. 11. R2 is provided to make this LPF operable for the high frequency components of the input.

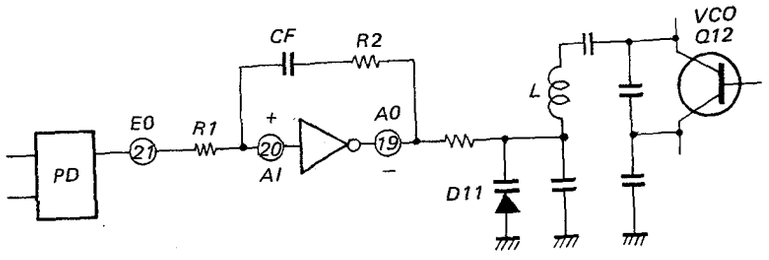

Fig. 10. Active filter and VCO connection

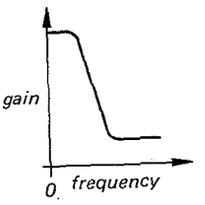

Fig. 11. Frequency response of LPF

(4) Phase Detector Overall Operation

Considering the overall operation, if the frequency of the VCO is assumed to be higher than desired:

- The PD output (EO) sends out a positive pulse close to VDD.
- This pulse is filtered by the active filter, and since the filter amp inverts the polarity, the filter output is dc approaching ground level.
- The reverse bias applied to D11 decreases and its equivalent capacitance increases.
- Since D11 is connected as a part of the VCO oscillation circuit, the oscillation frequency decreases and is locked at the desired frequency.

(5) μPD861C

Since the internal operation has already been described in the PLL section, only the other operations are described here.

VDD is 5 V.

The dividing ratio of the programmable divider is 3–255. Moreover, the maximum frequency of the input is approximately 2 MHz.

The maximum frequency of the signal applied to terminals X1 and X2 is 11 MHz. LOW (0) and HIGH (1) for all the signal inputs and outputs indicate:

0 ---- 1 V or less

1 ---- 4 V or more

To set the divider in BCD code, the terminal M is HIGH level to get a 90 offsetting. When this terminal M is held LOW, the divider is not performing at 90 offsetting and is divided by the specified number of the BCD code.

N of 0–2 should not be programmed when direct division is performed.

Sony Corporation

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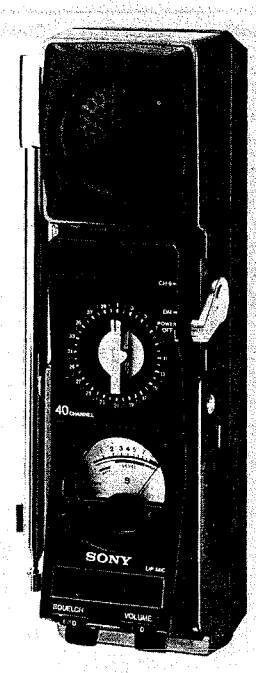
78C0631-1
Printed in Japan

ICB-1020

US Model



CITIZENS BAND TRANSCEIVER

SPECIFICATIONS

GENERAL

Operating Frequency: Within the 26.965 to 27.405 MHz band
40 channels full coverage

Antenna: Telescopic Antenna
Approx. 149 cm (4 feet 10 inches)

Communication System: Push-to-talk system

Power Requirement: 12 V dc
Battery size-AA, 8 pcs.
(IEC designation R6)
120 V ac, 60 Hz, with AC power adaptor AC-12
Car battery cord DCC-6 for 12 V car battery

Dimensions: Approx. 92 (w) x 270 (h) x 103.5 (d) mm
$3\frac{5}{8}$ (w) x $10\frac{5}{8}$ (h) x $4\frac{1}{2}$ (d) inches
including projecting parts and controls

Weight: Approx. 1250 g, 2 lb 12 oz with batteries

TRANSMITTING SECTION

Transmitting Power: 1 W

Frequency Tolerance: ±0.005% (-30°C to +60°C)

Circuit System: PLL synthesizer with quartz crystal controlled circuit

Modulation: Collector moduration in final and driver stage

Current Drain: 250 mA without modulation

RECEIVING SECTION

Circuit System: PLL synthesizer with quartz crystal controlled circuit
Dual conversion superheterodyne

Maximum Sensitivity: Less than 0.5 μV at 50 mW output

Intermediate Frequency: 1st: 10.695 MHz
2nd: 455 kHz

Audio Power Output: 340 mW at 10% distortion

Current Drain: 70 mA at zero signal

Speaker: Approx. 5.7 cm (2¼ inches) dia., 8Ω

— continued on page 2 —

NOTICE

REPAIR AND ADJUSTMENTS (OTHER THAN THE SPECIFIED OPERATING ADJUSTMENT) BY PERSONS NOT HOLDING A VALID FCC FIRST OR SECOND CLASS RADIOTELEPHONE OPERATORS LICENSE IS ILLEGAL. USE OF REPLACEMENT PARTS OTHER THAN THE EXACT SONY REPLACEMENT PARTS APPROVED FOR USE IN THIS DEVICE IS ILLEGAL.

SONY®

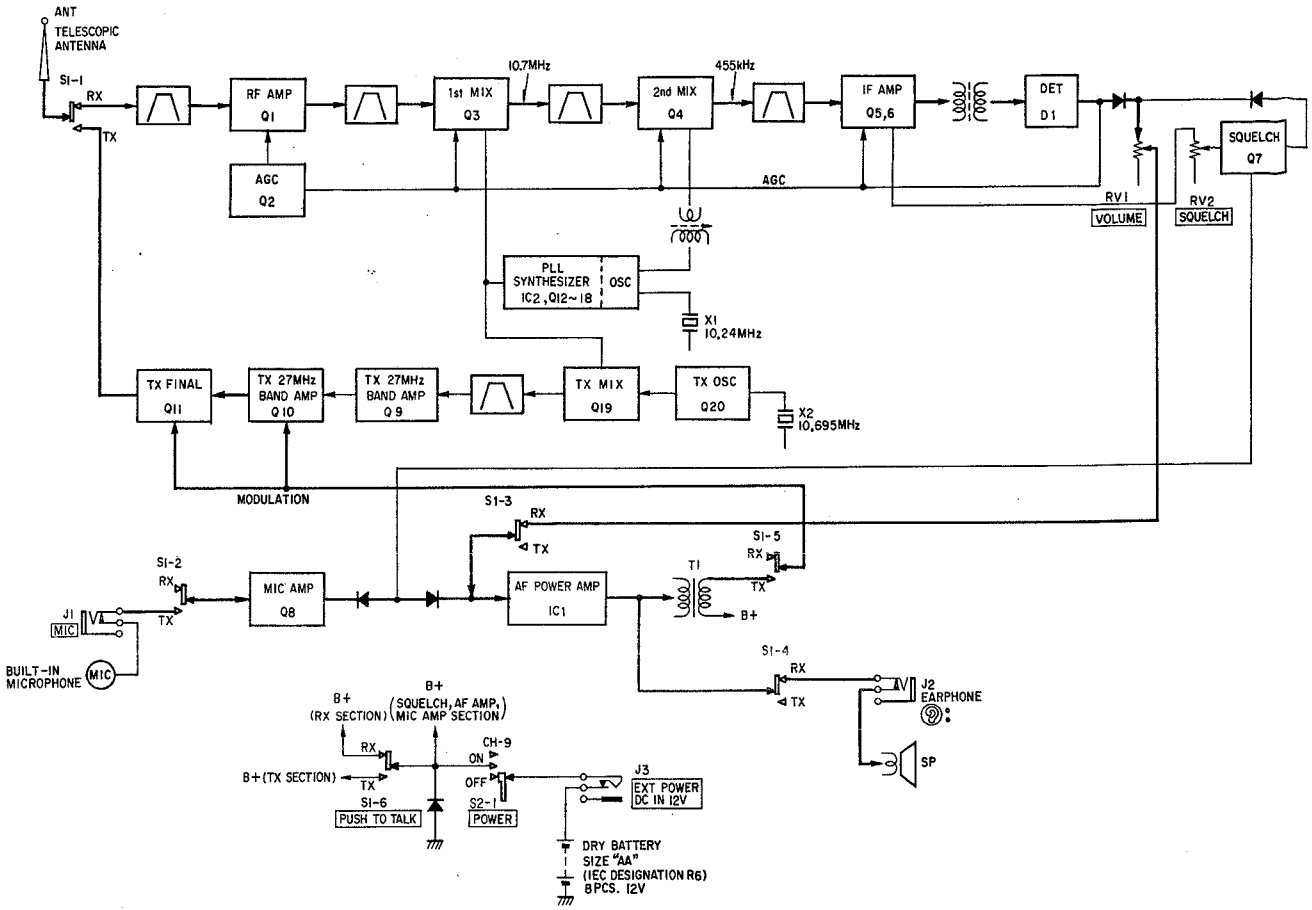
SERVICE MANUAL

Transmitting and Receiving Frequencies:

Channel	Frequency	Channel	Frequency	Channel	Frequency
1	26.965 MHz	15	27.135 MHz	29	27.295 MHz
2	26.975 MHz	16	27.155 MHz	30	27.305 MHz
3	26.985 MHz	17	27.165 MHz	31	27.315 MHz
4	27.005 MHz	18	27.175 MHz	32	27.325 MHz
5	27.015 MHz	19	27.185 MHz	33	27.335 MHz
6	27.025 MHz	20	27.205 MHz	34	27.345 MHz
7	27.035 MHz	21	27.215 MHz	35	27.355 MHz
8	27.055 MHz	22	27.225 MHz	36	27.365 MHz
9	27.065 MHz	23	27.255 MHz	37	27.375 MHz
10	27.075 MHz	24	27.235 MHz	38	27.385 MHz
11	27.085 MHz	25	27.245 MHz	39	27.395 MHz
12	27.105 MHz	26	27.265 MHz	40	27.405 MHz
13	27.115 MHz	27	27.275 MHz		
14	27.125 MHz	28	27.285 MHz		

SECTION 1
OUTLINE

1-1. BLOCK DIAGRAM



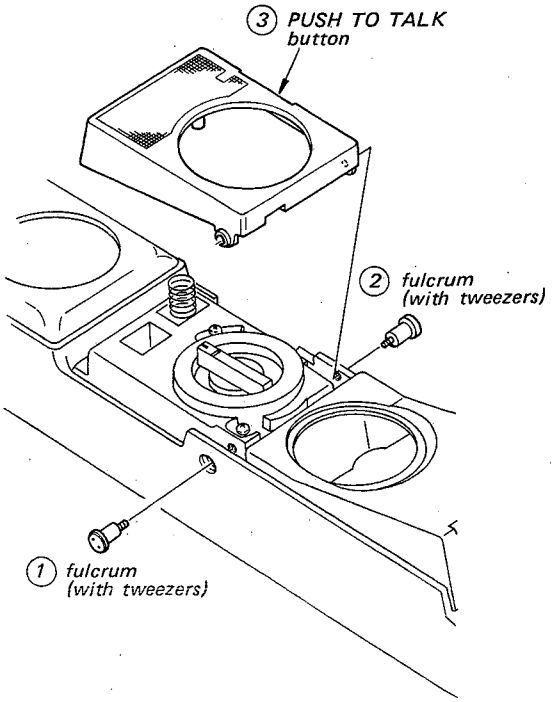
SECTION 2
DISASSEMBLY

2-1. REMOVAL AND INSTALLATION

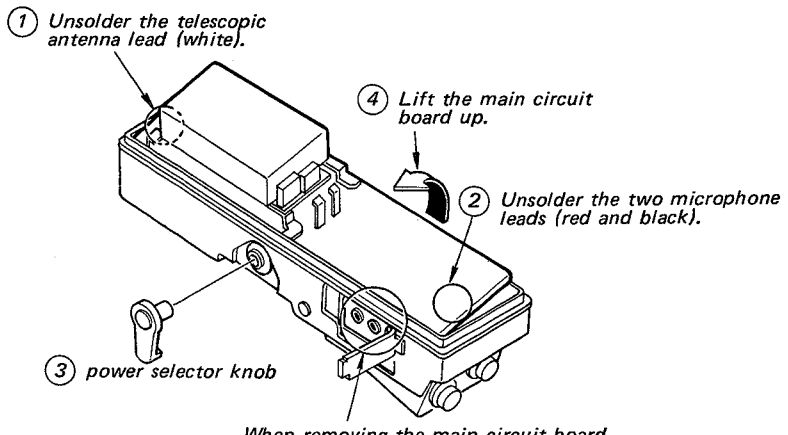
Rear Case Removal

Remove six screws.
B 3×60 (four) and
B 3×50 (two).

PUSH TO TALK Button Removal



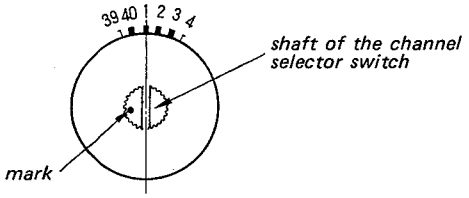
Main Circuit Board Removal

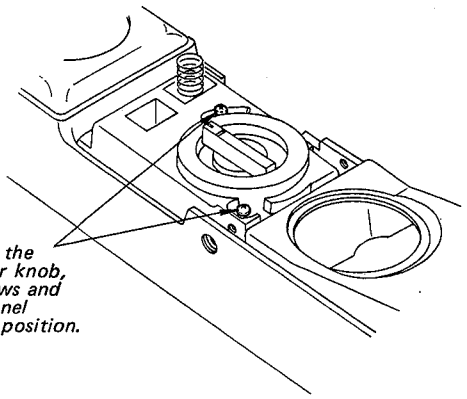

① Unsolder the telescopic antenna lead (white).
④ Lift the main circuit board up.
② Unsolder the two microphone leads (red and black).
③ power selector knob
When removing the main circuit board, take care not to hook this position.

Channel selector switch can be removed.

Note on Replacing Channel Selector Knob and Switch

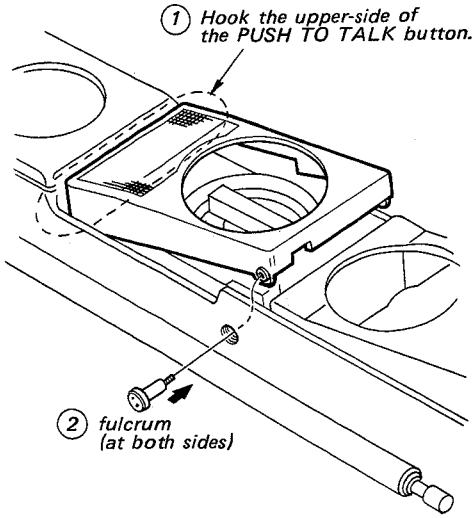
(1) *Set the shaft of the channel selector switch as shown below.*





(2) *After installing the channel selector knob, loosen the screws and adjust the channel selector switch position.*

PUSH TO TALK Button Installation



SECTION 3
ADJUSTMENT

Setting:

Unless otherwise specified, set the switches and controls as follows:

POWER switch:	ON
Channel selector:	18
EMERGENCY CH switch:	OFF
VOLUME control:	fully clockwise
SQUELCH control:	fully counterclockwise
Power supply voltage:	12 V dc (Take care of the polarity)

Test Equipment Required:

- Rf signal generator (AM).
- Regulated dc power supply (12 V, 3 A).
- Rf dummy load (non-inductive 50 Ω, more than 1 W).
- Oscilloscope (30 MHz, with triggered CH1 only provision).
- In-line rf power/SWR meter (50 Ω, more than 3 W, up to 50 MHz).
- Frequency counter (30 MHz, sensitivity 50 mV).
- VOM.

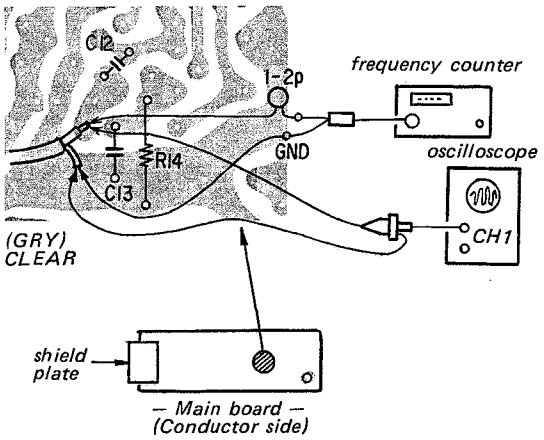
Note on Adjustment:

1. TX means transmitter.
   RX means receiver.
2. Unless otherwise specified, input levels are to be as low as possible for the adjustments.
3. When adjusting the main circuit board, take care not to connect the shield case of the synthesizer circuit board with the plus terminal of the battery case.
4. The coaxial cables used for connecting the printed pattern and the rf power meter, and the rf power meter to the dummy load are to be as short as possible. If the cables are long, SWR indication differs from the true value due to the cable loss.
5. It is preferable to use a low-capacitive probe with the frequency counter not to interrupt the circuit connected. If such a probe is not available, precisely follow the procedure in this manual.
6. When touching the telescopic antenna with transmitted, it is sometime to be slightly shocked by the transmitting power. It is not the trouble of the set.

10.24 MHz Adjustment

Procedure:

Mode: receive



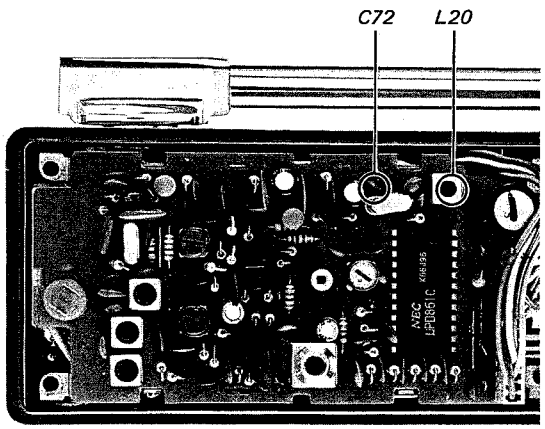
1. Adjust C72 for a 10.24 MHz ± 200 Hz reading on the frequency counter.

Value of C72	Frequency
small ↕ large	up ↕ down

2. Adjust L20 for a maximum waveform reading on the oscilloscope.

Adjustment Location:

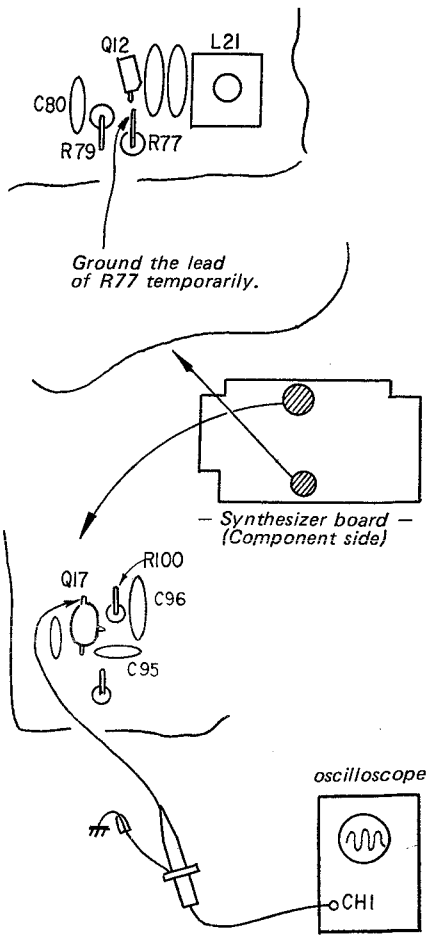
– Synthesizer board –



Tripler Adjustment

Procedure:

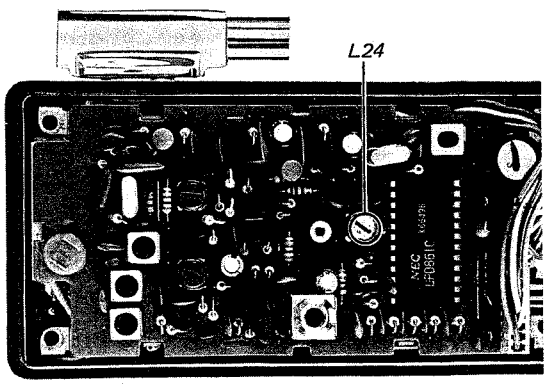
Mode: receive



Adjust L24 for a maximum waveform reading (15.36 MHz) on the oscilloscope.

Adjustment Location:

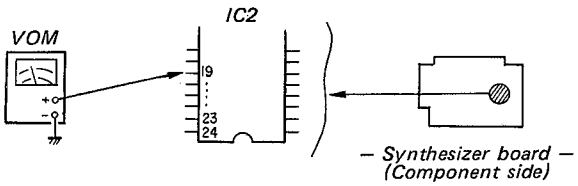
– Synthesizer board –



VCO Adjustment

Procedure:

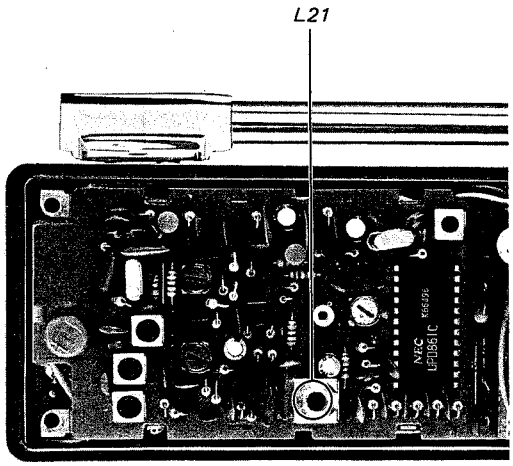
Mode: receive



1. Channel selector: 1
   Adjust L21 with a plastic hexagonal screwdriver for a 1V dc reading on the VOM.
2. Change the channel selector from 1 through 40. VOM reading should gradually change from 1V (channel 1) to about 3V (channel 40).

Adjustment Location:

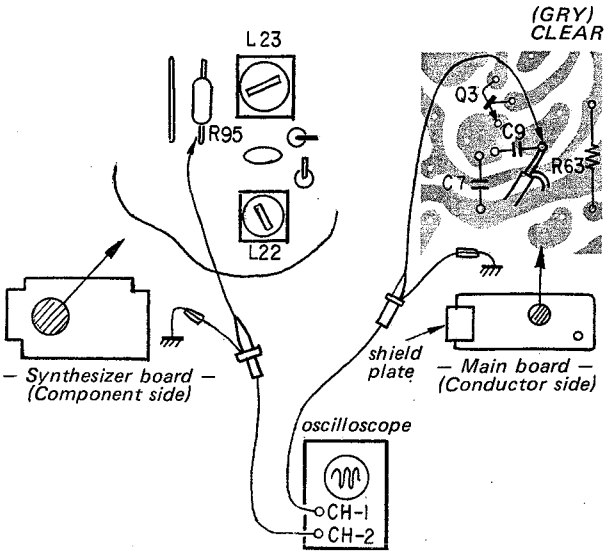
– Synthesizer board –



PLL Output Adjustment

Procedure:

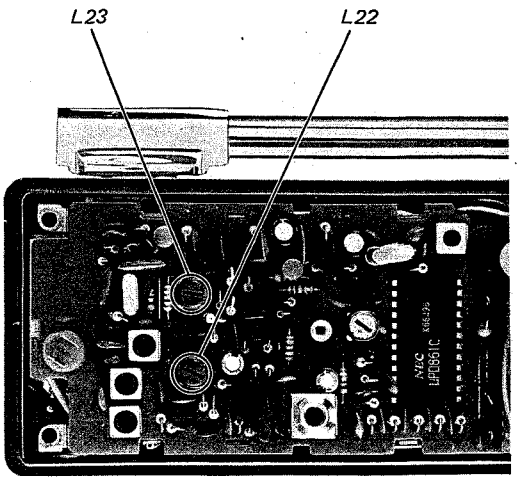
Mode: receive



1. Adjust L22 for a maximum waveform reading on the oscilloscope at R95 (CH2).
2. Adjust L23 for a maximum waveform reading on the oscilloscope at C9 (CH1).

Adjustment Location:

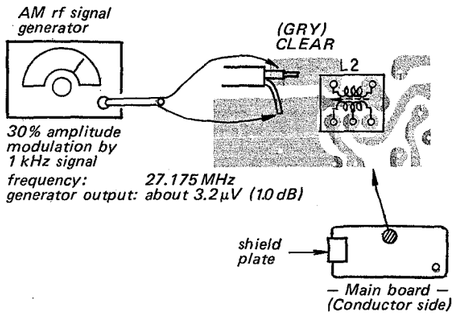
– Synthesizer board –

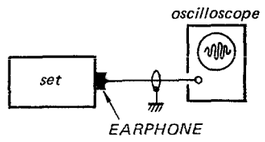


RX RF, 1st IF and 2nd IF Adjustment

Procedure:

Mode: receive

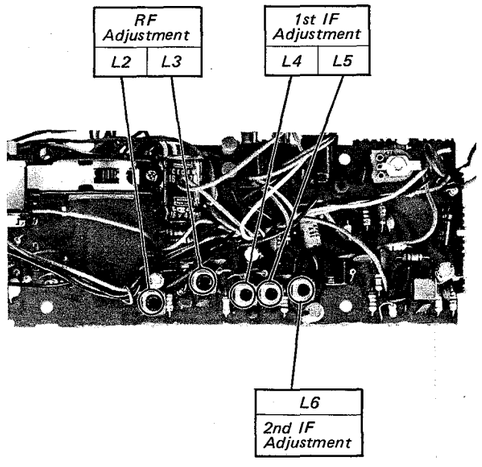

AM rf signal generator
(GRY) CLEAR
L2
30% amplitude modulation by 1 kHz signal
frequency: 27.175 MHz
generator output: about 3.2 μV (1.0 dB)
shield plate
– Main board – (Conductor side)



Adjust L2 through L6 for a maximum waveform reading on the oscilloscope.

Adjustment Location:

– Main board –



SQUELCH Adjustment

Setting:

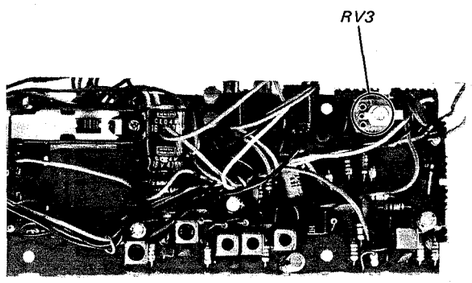
SQUELCH control: center of rotation
Mode: receive

Procedure:

1. Adjust RV3 to the point where the noise output from the speaker just disappears.
2. Turn SQUELCH control from minimum to maximum and check that squelch operates and noise disappears at the center of SQUELCH control rotation.

Adjustment Location:

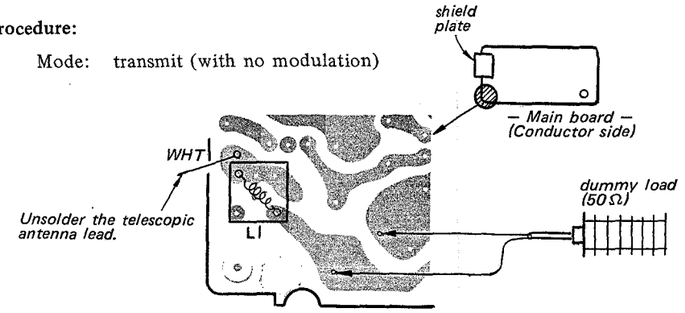
– Main board –

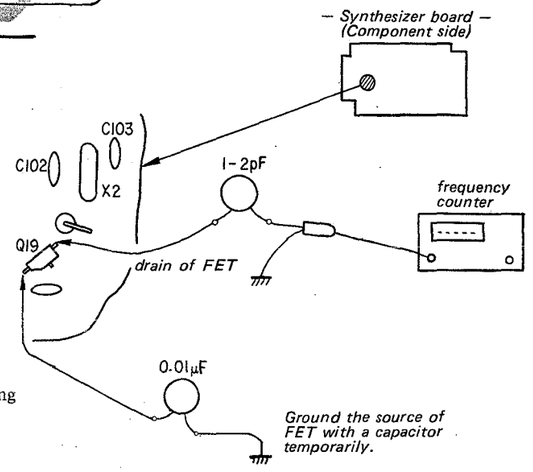


TX 10.695 MHz Osc Adjustment

Procedure:

Mode: transmit (with no modulation)



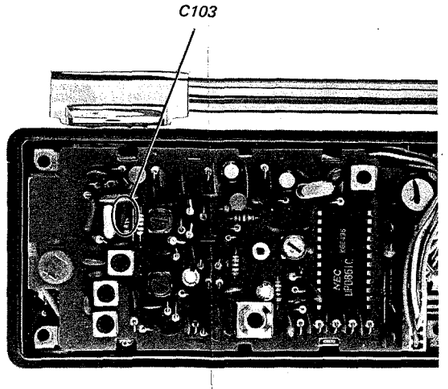


Adjust C103 for a 10.695 MHz ±200 Hz reading on the frequency counter.

Value of C103	Frequency
small ↕ large	up ↕ down

Adjustment Location:

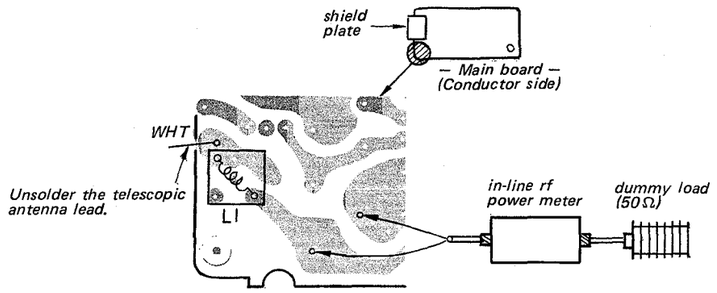
– Synthesizer board –



TX CW Output Adjustment

Procedure:

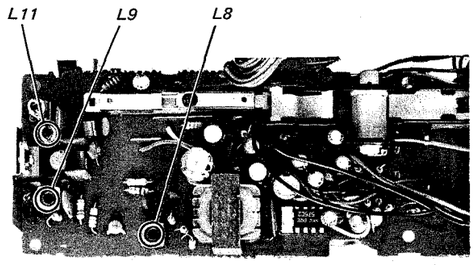
Mode: transmit (with no modulation)



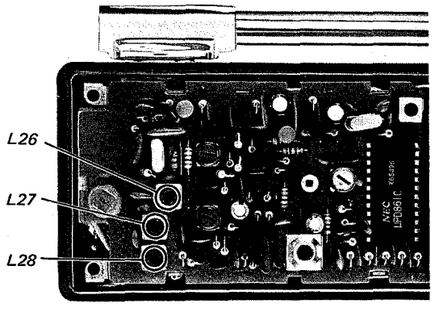
1. Adjust L11, L9 and L8 for a maximum reading on the in-line rf power meter.
   The reading should be 1W±0.2W (about 20Vp-p).
2. Set the channel selector to the channel 40 and adjust L28 and L26 for a maximum reading on the in-line rf power meter.
3. Set the channel selector to the channel 1 and adjust L27 for a maximum reading on the in-line rf power meter.
4. Repeat above steps several times and make the difference between the meter readings to be small.

Adjustment Location:

– Main board –



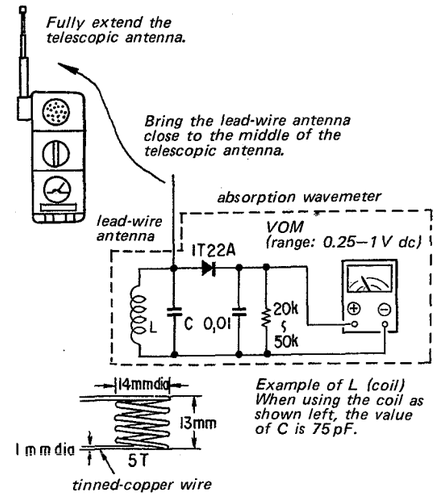
– Synthesizer board –



TX Loading Coil Adjustment

Procedure:

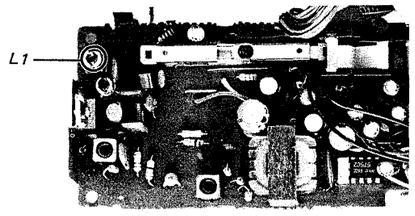
Mode: transmit (with no modulation)



Adjust L1 for a maximum reading on VOM.

Adjustment Location:

– Main board –

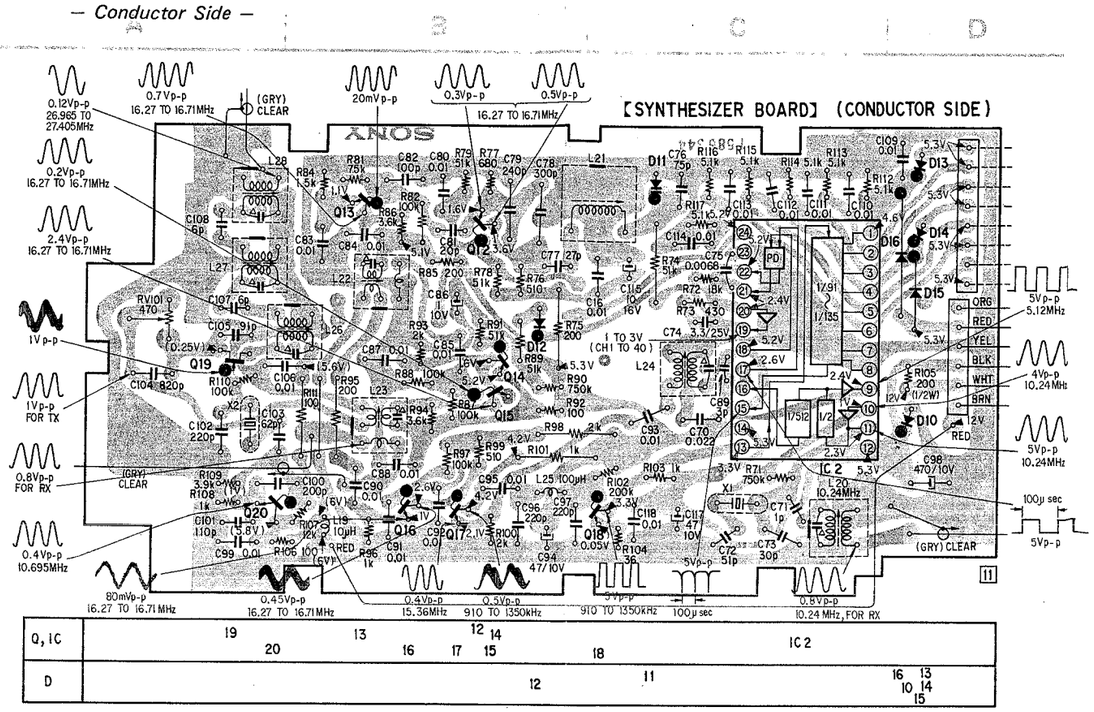


MEMO

SECTION 4
DIAGRAMS

4-1. MOUNTING DIAGRAM — Synthesizer Board —

— Conductor Side —



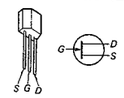
Note:

- ⊣▭ : indicates side identified with part number.
- ▩ : B+ pattern.
- DC resistance measurements are with coils connected on the circuit board, and are approximate.
- ( ) : TX
  no mark: RX

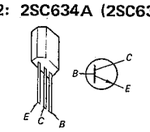
Replacement Semiconductors

For replacement, use semiconductors except in ( ).

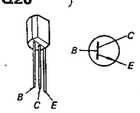
Q19: 2SK23A-923 (2SK23A)



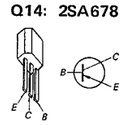
Q12: 2SC634A (2SC633A)



Q13, Q15–18, Q20: 2SC710

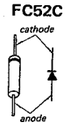


Q14: 2SA678

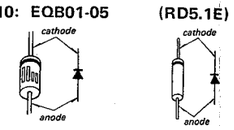


D12–16: 1S1555

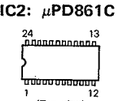
D11: FC52C (FC52M)



D10: EQB01-05 (RD5.1E)



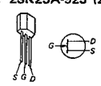
IC2: µPD861C



4-2. MOUNTING DIAGRAM

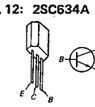
Replacement Semiconductors
For replacement, use semiconductors except in ( ).

Q1, 19: 2SK23A-923 (2SK23A)

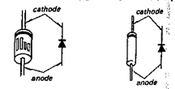


D1–4, D7–9, D12–16: 1S1555
D11: FC52C (FC52M)

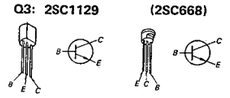
Q2, 7, 12: 2SC634A (2SC633A)



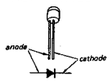
D5: EQB01-07 (RD6.2E)
D10: EQB01-05 (RD5.1E)



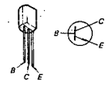
Q3: 2SC1129 (2SC668)



D6: TLR109

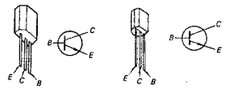


Q4–6, Q9, 13, Q15–18, Q20: 2SC710
Q10: 2SC773



IC1: μPC575C

Q8: 2SC632A (2SC1362)



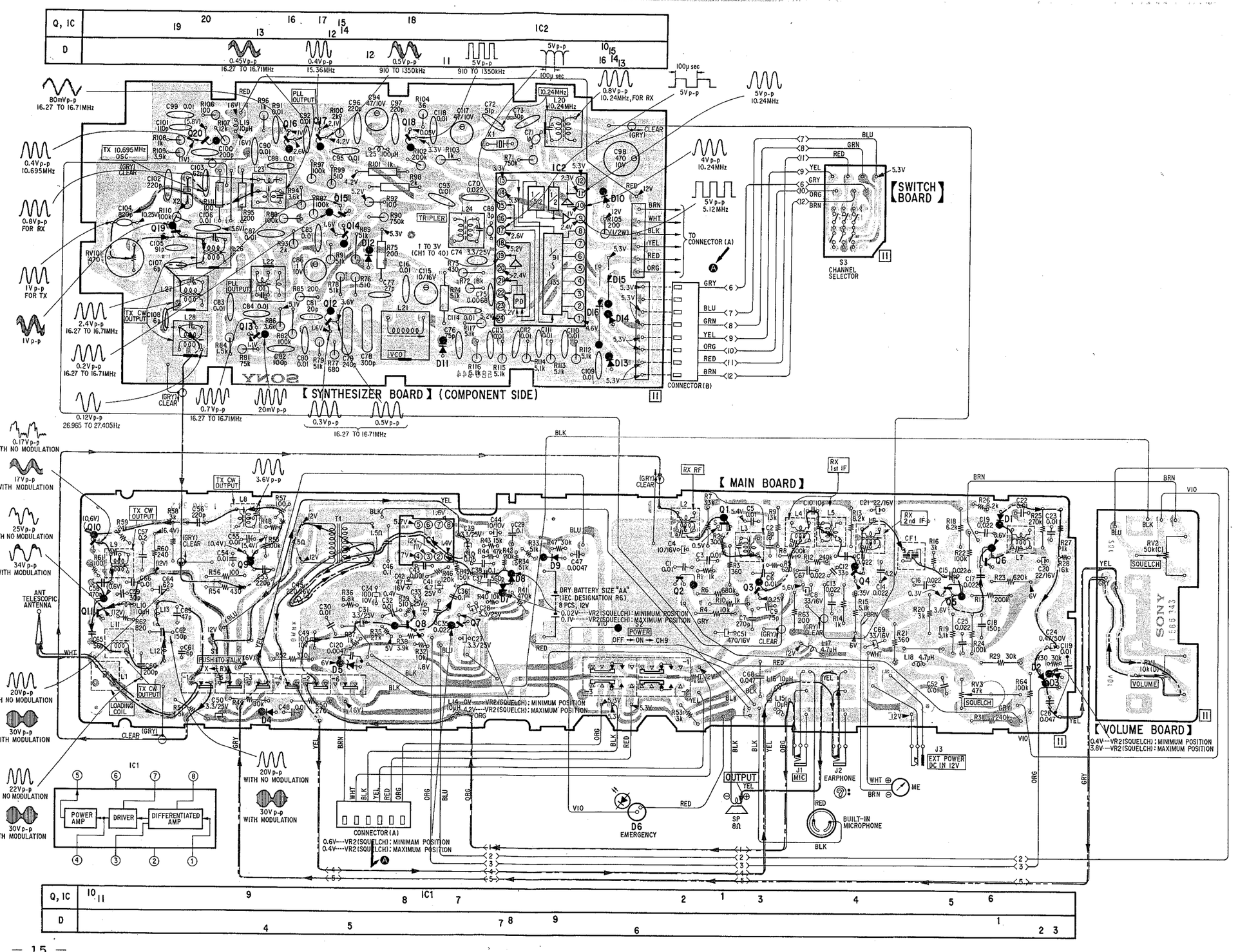
IC2: μPD861C

Q11: 2SC1760

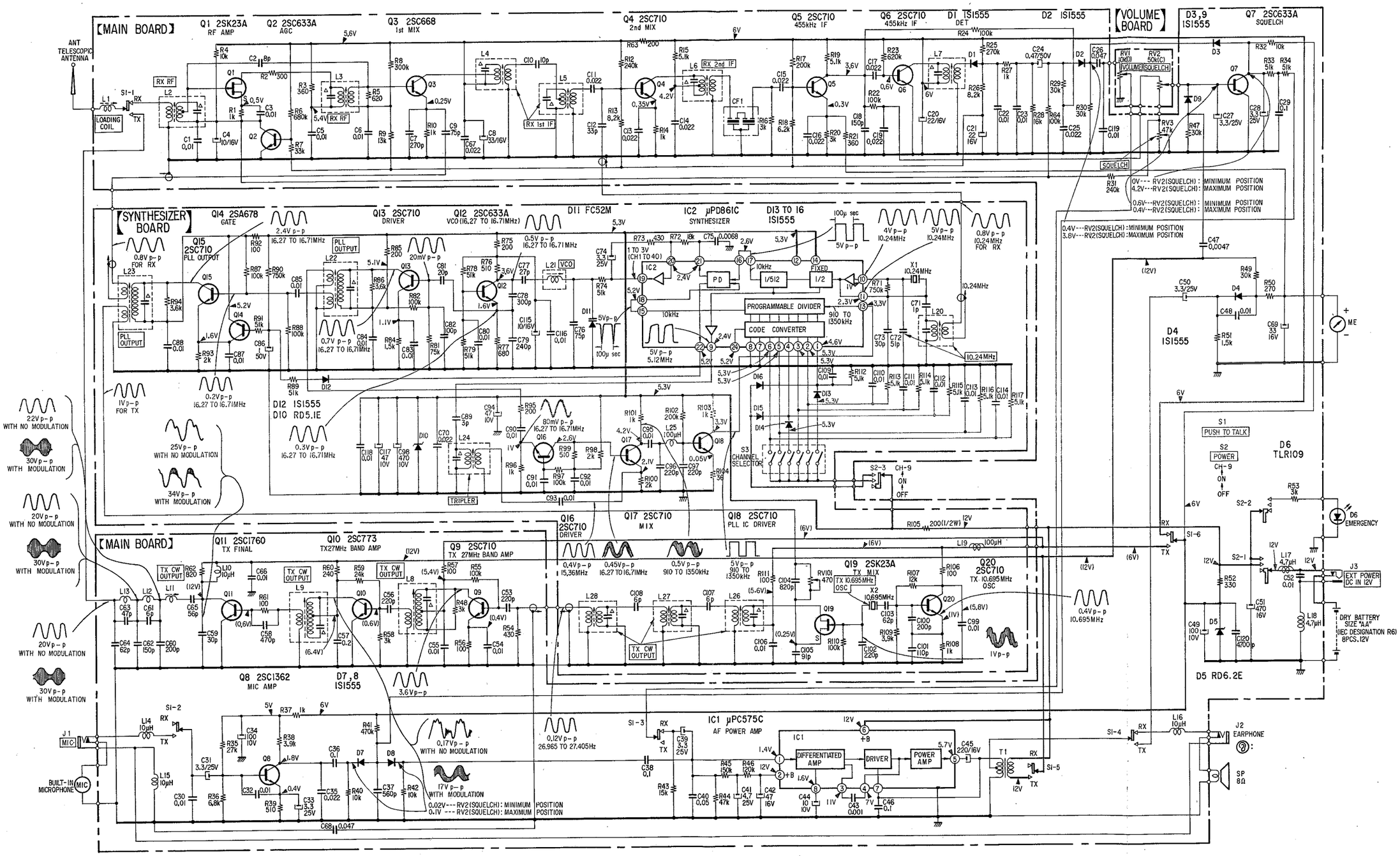
Q14: 2SA678

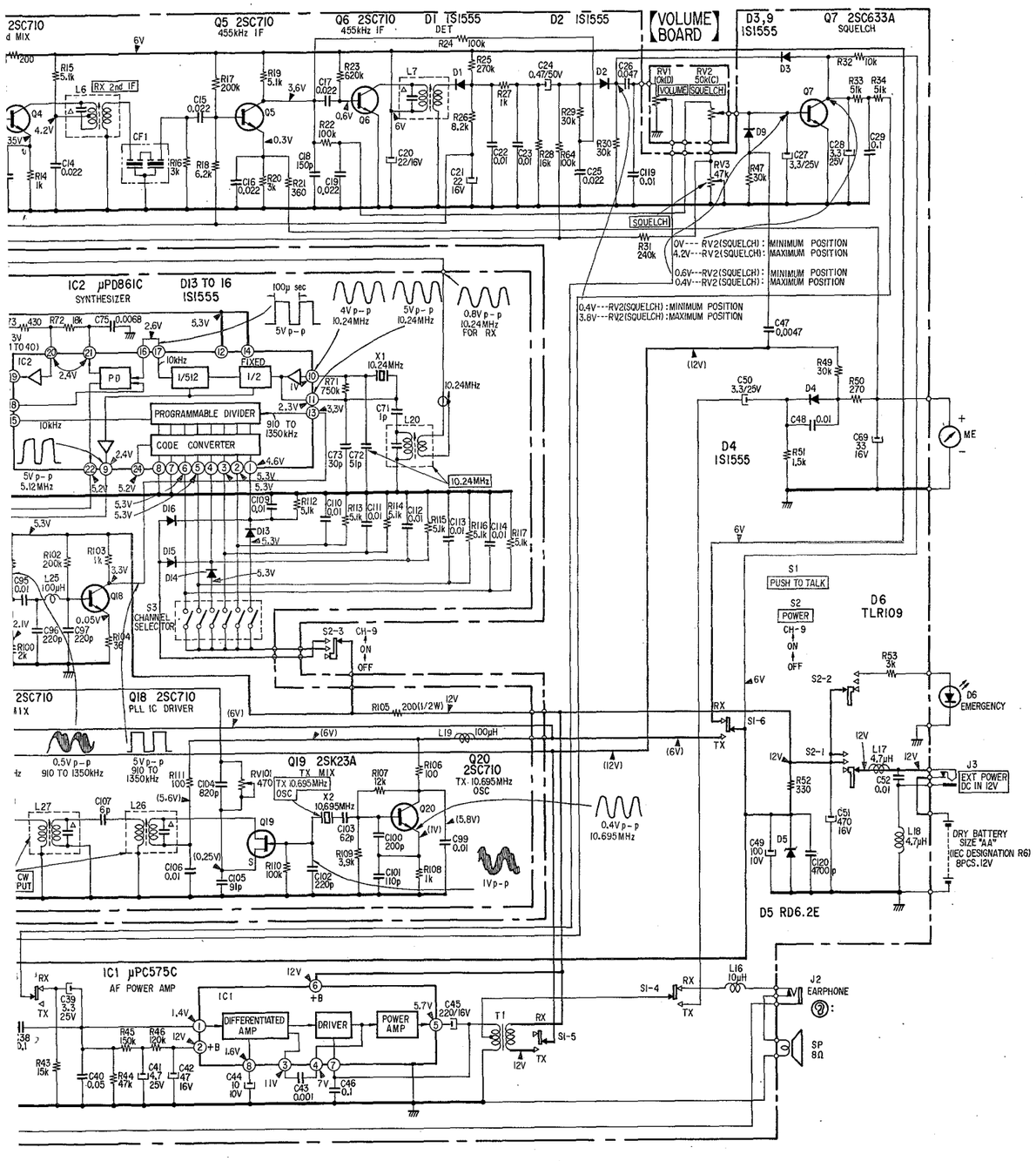
Note:

- : indicates side identified with part number.
- : B+ pattern.
- Signal Path
  - : TX
  - : RX
- DC resistance measurements are with coils connected on the circuit board, and are approximate.
- ( ) : TX
  no mark: RX



4-3. SCHEMATIC DIAGRAM





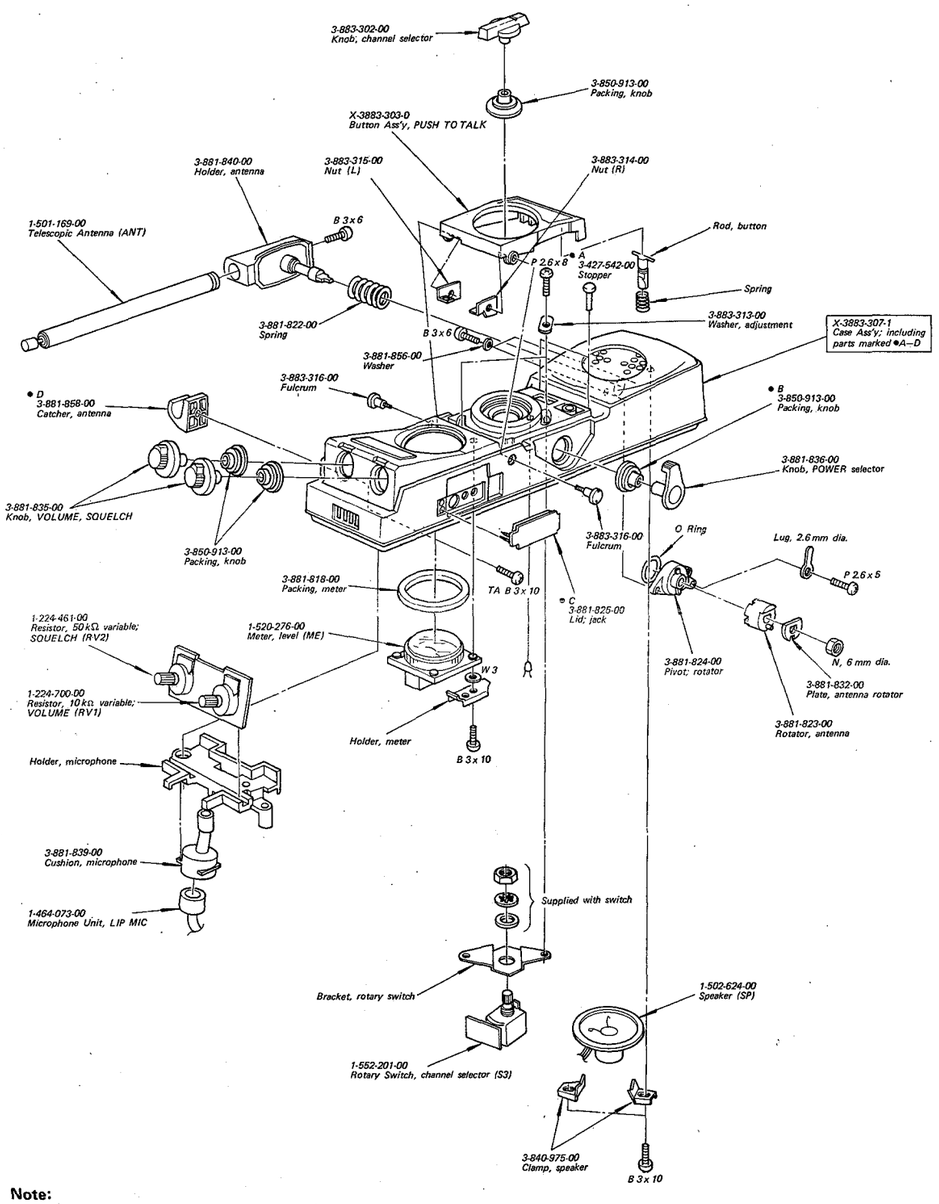
Note:

- TX: Transmitting
- RX: Receiving
- WITH MODULATION: 1 kHz, -60 dB signal is applied at J1 (MIC).
- All capacitors are in μF unless otherwise noted. pF = μμF 50WV or less are not indicated except for electrolytics.
- All resistors are in ohms, ¼W unless otherwise noted. kΩ = 1000Ω, MΩ = 1000 kΩ
- △: internal component.
- ▬▬: B+ bus.
- ▭: panel designation.
- ▭: adjustment for repair.
- Voltages are dc with respect to ground unless otherwise noted.
- Readings are taken under no signal conditions with a VOM (20 kΩ/V).
  ( ): TX
  no mark: RX
- Transistor base-emitter voltages are measured on the 2.5 V range.
- Voltage variations may be noted due to normal production tolerances.
- Switch

Ref. No.	Switch	Position
S1-1–6	PUSH TO TALK	RX
S2-1–3	POWER	OFF
S3	CHANNEL SELECTOR	CH1

SECTION 5
EXPLODED VIEWS

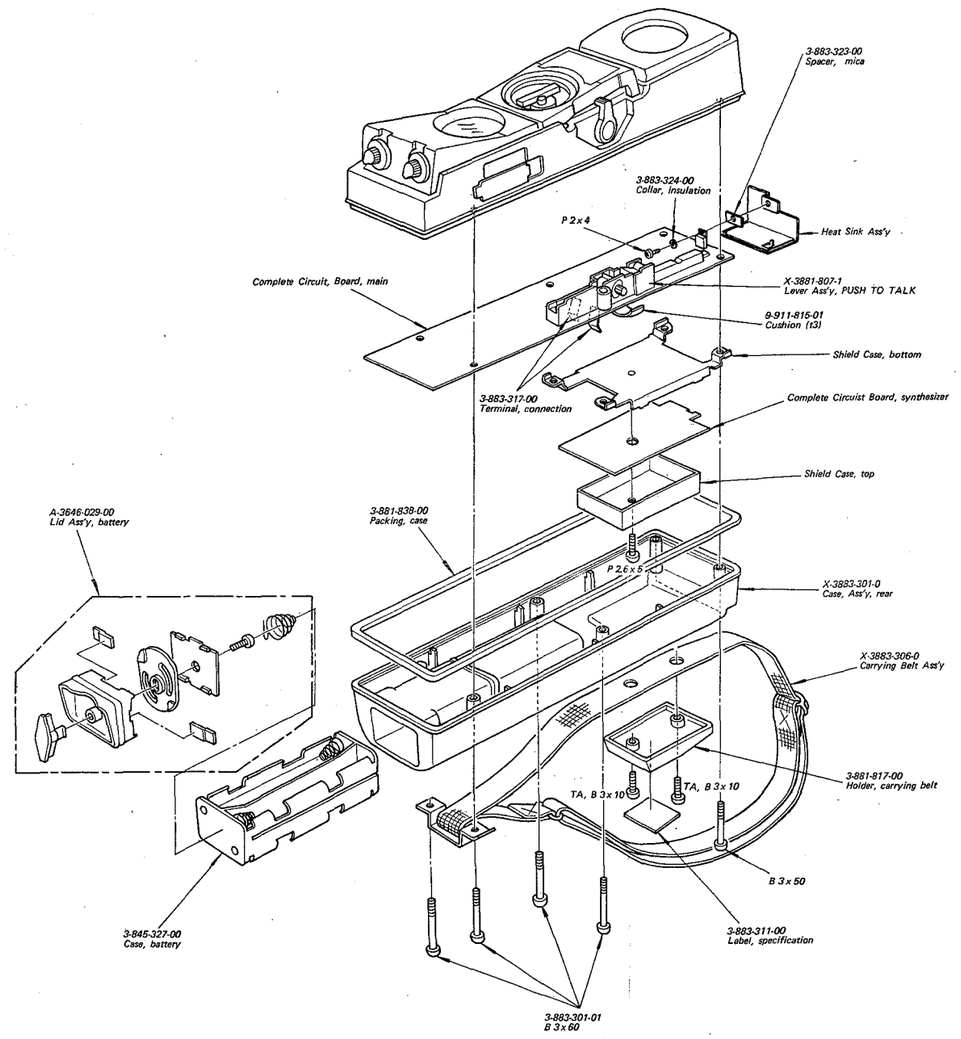
5-1.



Note:

- Items with no part number and/or no description are not stocked because they are seldom required for routine service.
- All screws are Phillips (cross recess) type unless otherwise noted.
  (–) = slotted head

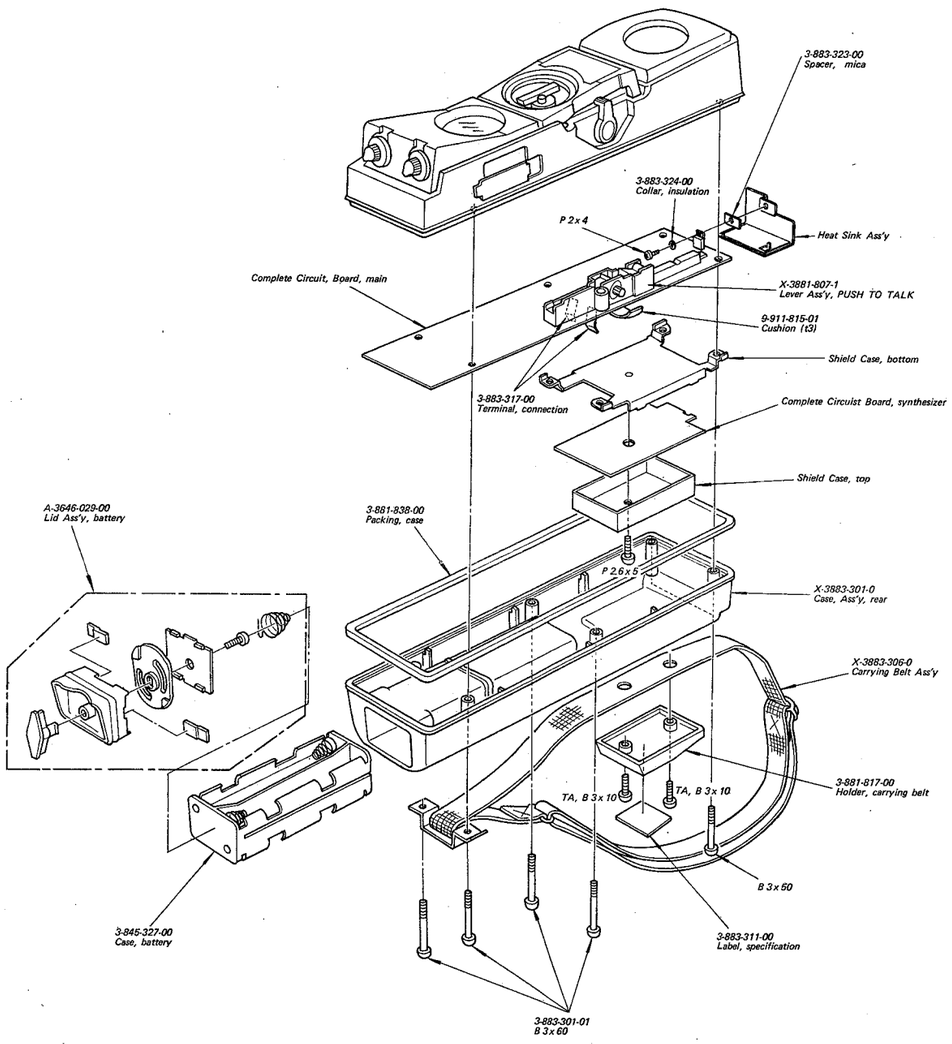
5-2.



Note:

- Items with no part number and/or no description are not stocked because they are seldom required for routine service.
- All screws are Phillips (cross recess) type unless otherwise noted.
  (–) = slotted head

5-2.



Note:

- Items with no part number and/or no description are not stocked because they are seldom required for routine service.
- All screws are Phillips (cross recess) type unless otherwise noted.
  (–) = slotted head

SECTION 6
ELECTRICAL PARTS LIST

Ref. No.	*Part No.*	*Description*
		SEMICONDUCTORS
		Transistors
⇒ Q1		2SK23A-923
⇒ Q2		2SC634A
⇒ Q3		2SC1129
Q4–6		2SC710
⇒ Q7		2SC634A
⇒ Q8		2SC632A
Q9		2SC710
Q10		2SC773
Q11		2SC1760
⇒ Q12		2SC634A
Q13		2SC710
Q14		2SA678
Q15–18		2SC710
⇒ Q19		2SK23A-923
Q20		2SC710
		ICs
IC1		μPC575C
IC2		μPD861C
		Diodes
D1–4		1S1555
⇒ D5		EQB01-07
D6		TLR109
D7–9		1S1555
⇒ D10		EQB01-05
⇒ D11		FC52C
D12–16		1S1555
		COILS
L1	1-459-188-00	Core type
L2	1-401-384-21	Antenna
L3	1-425-374-21	FM RF
L4,5	1-403-243-00	FM IFT
L6	1-403-110-00	IFT
L7	1-403-137-00	IFT, detector
L8,9	1-425-744-00	RF
L10	1-407-157-XX	Microinductor, 10μH
L11	1-425-627-00	FM RF
L14–16	1-407-157-XX	Microinductor, 10μH
L17,18	1-407-186-XX	Microinductor, 4.7μH
L19	1-407-157-XX	Microinductor, 10μH
L20	1-403-243-00	FM IFT
L21	1-405-754-00	Osc
L22,23	1-425-947-00	Output
L24	1-425-946-00	Output
L25	1-407-169-XX	Microinductor, 100μH
L26–28	1-425-374-21	FM RF

CAPACITORS

All capacitors are in μF and ceramic unless otherwise noted.
50WV or less are not indicated except for electrolytics. pF = μμF, elect = electrolytic

C1	1-161-013-11	0.01		(boundary layer)
C2	1-102-945-11	8p		
C3	1-161-013-11	0.01		(boundary layer)
C4	1-121-651-11	10	16V	elect
C5,6	1-161-013-11	0.01		(boundary layer)
C7	1-102-111-11	270p		
C8	1-121-403-11	33	16V	elect
C9	1-101-890-11	75p		
C10	1-102-947-11	10p		
C11	1-161-034-11	0.022		(boundary layer)
C12	1-102-963-11	33p		
C13,14	1-161-034-11	0.022		(boundary layer)
C15	1-101-005-11	0.022		
C16	1-161-034-11	0.022		(boundary layer)
C17	1-101-005-11	0.022		
C18	1-101-361-11	150p		
C19	1-101-005-11	0.022		
C20,21	1-121-479-11	22	16V	elect
C22,23	1-101-004-11	0.01		
C24	1-121-726-11	0.47	50V	elect
C25	1-101-005-11	0.022		

⇒: Due to standardization, interchangeable replacements may be substituted for parts specified in the diagrams.

Ref. No.	Part No.	Description		
C26	1-161-036-11	0.047		(boundary layer)
C27,28	1-121-392-11	3.3	25V	elect
C29	1-127-019-11	0.1		aluminum
C30	1-101-004-11	0.01		
C31	1-121-392-11	3.3	25V	elect
C32	1-101-004-11	0.01		
C33	1-121-392-11	3.3	25V	elect
C34	1-121-414-11	100	10V	elect
C35	1-101-005-11	0.022		
C36	1-101-797-11	0.1		
C37	1-102-115-11	560p		
C38	1-101-797-11	0.1		
C39	1-121-392-11	3.3	25V	elect
C40	1-101-796-11	0.05		
C41	1-121-395-11	4.7	25V	elect
C42	1-121-409-11	47	16V	elect
C43	1-161-026-11	0.001		
C44	1-131-228-11	10	10V	tantalum
C45	1-131-421-11	220	16V	tantalum
C46	1-161-038-11	0.1		(boundary layer)
C47	1-161-009-11	0.0047		
C48	1-101-004-11	0.01		
C49	1-121-414-11	100	10V	elect
C50	1-121-392-11	3.3	25V	elect
C51	1-121-426-11	470	16V	
C52	1-101-004-11	0.01		
C53	1-102-110-11	220p		
C54,55	1-161-013-11	0.01		(boundary layer)
C56	1-102-110-11	220p		
C57	1-101-798-11	0.2		(boundary layer)
C58	1-102-823-11	470p		
C59	1-102-962-11	30p		
C60	1-107-092-11	200p		silvered mica
C61	1-107-103-11	6p		silvered mica
C62	1-107-089-11	150p		silvered mica
C63	1-107-077-11	47p		silvered mica
C64	1-107-080-11	62p		silvered mica
C65	1-101-884-11	56p		
C66	1-161-013-11	0.01		(boundary layer)
C67	1-101-005-11	0.022		
C68	1-101-006-11	0.047		

Ref. No.	Part No.	Description		
C70	1-101-005-11	0.022		
C71	1-102-934-11	1p		
※C72	1-107-078-11	51p		silvered mica
C73	1-107-072-11	30p		silvered mica
C74	1-131-206-11	3.3	25V	tantalum
C75	1-161-069-11	0.0068		(boundary layer)
C76	1-102-761-11	75p		
C77	1-102-883-11	27p		
C78	1-107-096-11	300p		silvered mica
C79	1-107-094-11	240p		silvered mica
C80	1-101-004-11	0.01		
C81	1-102-958-11	20p		
C82	1-102-973-11	100p		
C83–85	1-101-004-11	0.01		
C86	1-121-391-11	1	50V	elect
C87	1-161-070-11	0.01		(boundary layer)
C88	1-101-004-11	0.01		
C89	1-102-936-11	3p		
C90–93	1-101-004-11	0.01		
C94	1-121-352-11	47	10V	elect
C95	1-101-004-11	0.01		
C96,97	1-102-978-11	220p		
C98	1-121-425-11	470	10V	elect
C99	1-101-004-11	0.01		
C100	1-107-092-11	200p		silvered mica
C101	1-107-086-11	110p		silvered mica
C102	1-107-093-11	220p		silvered mica
※C103	1-107-080-11	62p		silvered mica
C104	1-102-117-11	820p		
C105	1-107-084-11	91p		silvered mica
C106	1-161-013-11	0.01		(boundary layer)
C107,108	1-107-103-11	6p		silvered mica
C109–114	1-101-004-11	0.01		
C115	1-121-651-11	10	16V	elect
C116	1-101-004-11	0.01		
C117	1-121-352-11	47	10V	elect
C118	1-101-004-11	0.01		
C119	1-161-013-11	0.01		(boundary layer)
C120	1-161-030-11	4700p		

※: C72 10.24 MHz adjustment
C103 TX 10.695 MHz osc adjustment

Ref. No.	*Part No.*	*Description*
		RESISTORS
		All resistors are in ohms. Common ¼W carbon resistors are omitted. Check schematic diagram for values.
R105	1-244-928-11	200 ½W carbon
RV1	1-224-700-00	10 k, variable; VOLUME
RV2	1-224-461-00	50 k, variable; SQUELCH
RV3	1-224-647-XX	47 k, adjustable
RV101	1-224-248-00	470, adjustable
		SWITCHES
S1	1-516-399-21	Slide, PUSH TO TALK RX/TX
S2	1-516-681-00	Slide, POWER
S3	1-552-201-00	Rotary, channel selector
		JACKS
J1,2	1-507-398-00	MIC, EARPHONE
J3	1-507-459-00	EXT POWER DC IN 12V
		MISCELLANEOUS
ANT1	1-501-169-00	Telescopic Antenna
CF1	1-527-290-00	Ceramic Filter
ME	1-520-276-00	Meter, level
SP	1-502-624-00	Speaker
T1	1-425-971-00	Transformer, modulator
X1	1-527-293-00	Crystal, 10.24 MHz
X2	1-527-294-00	Crystal, 10.695 MHz
	1-464-073-00	Mic Unit, LIP MIC; FU-21

ACCESSORIES & PACKING MATERIALS

Part No.	*Description*
X-3881-605-0	FCC Document Ass'y
3-701-623-00	Bag, plastic
3-825-524-00	Label, caution
3-845-372-00	Sheet, protection
3-881-850-00	Bag, protection
3-883-331-00	Carton
3-883-332-00	Cushion, upper
3-883-333-00	Cushion, lower
3-995-785-21	Manual, instruction

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